Service Manual

TNC 306/360

10/00

Kundendienst/Service

HEIDENHAIN

Contents Service Manual TNC 306/360

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1. How to use this Service Manual

The service manual TNC 306/360 can be used to diagnose, locate and eliminate errors on machine tools controlled by TNC.

In order to correctly judge the problems in an NC-controlled machine tool, fundamental knowledge of the machine tool and its drives, as well as their interaction with the control and the measuring systems is required. Incorrect behaviour of the machine tool can also result from improper use of the control, NC-programming errors and incorrect or not properly optimized machine parameters. For further information in this respect please refer to the **.Documentation of the Machine Tool Manufacturer**, to the **.Operating Manual** (HEIDENHAIN) and to the **.Technical Manual** (HEIDENHAIN).

The manual for the machine tool manufacturer is not enclosed with every control as is the operating manual. In general, it is only supplied to the machine tool manufacturer and is updated by HEIDENHAIN, Traunreut. Therefore, it is absolutely necessary to contact the machine tool manufacturer if errors occur that are due to a machine parameter or to the interface of the control. Support will, however, also be provided by the service department of HEIDENHAIN, Traunreut, and HEIDENHAIN agencies. Telephone numbers, addresses and telex/telefax numbers can be found on the back side of the cover page and on the back side of this service manual.

2. Minor Error Messages

The TNC 306/360 features a comprehensive integrated monitoring system to avoid input or operation errors, to locate errors and technical defects of the entire equimpent (TNC, measuring system, machine tool, cables etc). The monitoring system is a fixed component of the TNC hardware and software; it is always active when the control is switched on. If a technical defect or an operation error is detected, an error message in plain language is displayed on the screen.

To erase **minor error messages**, press CE.

Further error messages are described in the **Operating Manual TNC 306 and TNC 360,** in the **Technical Manual,** in the **Documentation by the machine tool manufacturer** or in the **Operating Instructions FE 401 B**.

Error Message	Sec.
AXIS DOUBLE PROGRAMMED	13.2
START POSITION INCORRECT	13.2
TOUCH POINT INACCESSIBLE	13.2
RANGE EXCEEDED	13.2
OPERATING PARAMETER ERASED	2.1
CYCL-PARAMETER INCORRECT	13.2
FAULTY RANGE DATA	13.2
ROTATION NOT PERMITTED	13.2
PLANE WRONGLY DEFINED	13.2
ENTRY VALUE INCORRECT	14
LIMIT SWITCH <Axis>	2.1
ERR: 001	12.6
ERR: 002	12.6
ERR: 003	12.6
ERR: 004	12.6
ERR: 010	12.6
ERR: 012	12.6
ERR: 013	12.6
ERR: 014	12.6
ERR: 100	12.6
ERR: 102	12.6
ERR: 103	12.6
ERR: 104	12.6

Error Message	Sec.
ERR: 105	12.6
ERR: 106	12.6
ERR: 107	12.6
ERR: 108	12.6
EMERGENCY STOP	17.4
EXT. IN-/OUTPUT NOT READY	14.6
WRONG AXIS PROGRAMMED	13.2
WRONG PROGRAM DATA	14.6
SCALING FACTOR NOT PERMITTED	13.2
PLC: PROGRAM MEMORY ERASED	15.1
POSITIONING ERROR <AXIS>	2.1
PROGRAM MEMORY EXCEEDED	15.1
EXCHANGE BUFFER BATTERY	8.6
MIRRORING NOT PERMITTED	13.2
RELAY EXT. DC VOLTAGE MISSING	17.4
POWER INTERRUPTED	2.1
EXCHANGE TOUCH PROBE BATTERY	13.2
STYLUS ALREADY IN CONTACT	13.2
PROBE SYSTEM NOT READY	13.2
TRANSFERRED VALUE ERRONEOUS	14.6
TIME LIMIT EXCEEDED	13.2

2.1 Causes of Minor Error Messages

OPERATING PARAMETERS ERASED

- With new and exchange controls, the machine parameters are always erased.
- Software replaced with different version (see section. 15.1)
- Buffer batteries and accumulator defective
- RAM error on PROCESSOR board

LIMIT SWITCH <AXIS>

- "Manual" operating mode:
  The pre-determined **software limit switch** or the **additional limit** in the auxiliary operating modes has been reached during traverse with the direction keys.
- "Automatic" operating mode:
  The **calculated position** of the current block is beyond the **software limit switch range** or beyond the **additional limit**. No positioning takes place.

Machine Parameters for Software Limit Switches

	X+	X-	Y+	Y-
Default setting	910.0	920.0	910.1	920.1
Selection via M2816, M2817	911.0	921.0	911.1	921.1
Selection via M2816, M2817	912.0	922.0	912.1	922.1

	Z+	Z-	IV+	IV-
Default setting	910.2	920.2	910.3	920.3
Selection via M2816, M2817	911.2	921.2	911.3	921.3
Selection via M2816, M2817	912.2	922.2	912.3	922.3

POWER INTERRUPTED

- After a reset signal at the power supply (e.g. line voltage drops)
- Important machine parameters may have been altered,
  e.g. MP 10, MP 210, MP 1390, MP 4010, MP 7210 etc.
- For further causes see section 15.1 and 17.4

POSITIONING ERROR <AXIS>

- The position monitoring system set in the machine parameters 1410 or 1710 has responded. (Check the approach behaviour of the axis and readjust, if necessary.)

EMERGENCY STOP

-The EMERGENCY STOP loop has been interrupted (see section 17.4).
-The PLC editor program has been translated

3. Major Error Messages and their Causes

The integrated monitoring system distinguishes between minor and major errors; major error messages (e.g. malfunctions of the encoders, of the drives or data processing errors) blink. In the case of gross errors, the control opens the contact **"Control Ready for Operation"** which causes an emergency stop of the machine tool.

By switching off the main switch or pressing END, the "emergency stop" state can be reset, provided that the error cause has been eliminated.

Screen Display (blinking error message)	Error Cause	
PROCESSOR CHECK ERROR XX	XX = 08	Bus error
	0C	Address errror
	10	Illegal instruction
	14	Division by 0
	18	Error output for CHK command (check range)
	20	Error output for TRAPV command (trap on overflow)
	24	Privilege infringement (supervisor command in the user-mode)
	28	Emulator trap
	2C	Emulator trap
	30	-
	34	-
	38	-
	3C	Interrupt vector not initialized
	40	Interrupt vector not initialized
	44	Interrupt vector not initialized
	48	Interrupt vector not initialized
	4C	-
	50	-
	54	-
	58	-
	5C	-
	60	False interrupt (interrupt with priority 0)
	64-7C	Interrupt autovector 4-7, user Interrupt. $100-$3FC
	94-BC	-

If the error message **"PROCESSOR CHECK ERROR XX"** (XX = identification letters, see above) comes up repeatedly, please return the **complete logic unit** to HEIDENHAIN for repair. Indicate also the **error message and the identification letters**.

Notes

Screen Display (blinking error message)	Error Cause
PROCESSOR CHECK ERROR X	X = 0 CRC sum control data incorrect 1 CRC sum machine parameter incorrect 2 Check sum of NC memory incorrect 3 Test plane incomplete 4 Crosstalk between data bits in the RAM 5 Crosstalk between addresses in the RAM 6 Stack overflow 7 CRC sum PLC program ASCII 8 CRC sum PLC program Opcode A Software error main processor B Software error display task C Time slice overflow D Command stack overflow control loop E Wrong command MAIN PROCESSOR TASK → CONTROL LOOP TASK F Wrong display mode MAIN PROCESSIR TASK → DISPLAY TASK H Control loop: "counter not latched" L Wrong control loop command M Operating voltage out of tolerance P Disabled software function is activated R PLC Positioning, datum shift (PLC), spindle orientation or limit switch shift active with MP7440 bit 2 = 1 or MP3030 = 1

If the error message **"PROCESSOR CHECK ERROR XX"** (X= identification letter, see above!) comes up repeatedly, please return the **complete logic unit** to HEIDENHAIN for repair. Indicate also the **error message and the identification letters**.

Notes

Screen Display (blinking error message)	Error Cause		
ERROR IN PLC PROGRAM XX	XX = 1A	NC start	complement missing
	1B	Rapid traverse	complement missing
	1C	Ref. pulse latch	complement missing
	1D	Feed enable	complement missing
	1E	PLC-Pos X [1]	complement missing
	1F	PLC-Pos Y [1]	complement missing
	1G	PLC-Pos Z [1]	complement missing
	1H	PLC-Pos IV [1]	complement missing
	1I	X+	complement missing
	1J	X-	complement missing
	1K	Y+	complement missing
	1L	Y-	complement missing
	1M	Z+	complement missing
	1N	Z-	complement missing
	1O	IV+	complement missing
	1P	IV-	
	1Q	Marker M2485	(M03)
		Marker M2486	(M04)
		Marker M2487	(M05)
		2 of 3 set	
	XX = 2A	SM X+	complement missing
	2B	SM X-	complement missing
	2C	SM Y+	complement missing
	2D	SM Y-	complement missing
	2E	SM Z+	complement missing
	2F	SM Z-	complement missing
	2G	SM IV+	complement missing
	2H	SM IV-	
	2K	(reserved)	
	2L	(reserved)	
	2O	(reserved)	
	50	Excessive nesting of subroutines	
	51	Stack underflow	
	52	Stack overflow	
	53	Time out PLC	
	54	CASE arguments are larger than the table values	

Note

1) Only active with compatibility mode TNC 355

Display (blinking)	Error Cause	
ERROR IN PLC-PROGRAM X	X = 7	Called label has not been defined.
	8	No end-program conditin found (the program does not contain an EM instruction or it contains a JP instruction without a following LBL instruction)
	9	Program is too long (RAM overflow) (insufficient memory for the program code which is to be generated)
ERROR IN PLC-PROGRAM XX	XX = 10	Assign with parenthesis (an =, S, SN, RN, or PS instruction has been programmed, although arithmetic parentheses are open)
	11	Excessive nesting of parentheses (more than 16 parentheses are open)
	12	Jump within a gating sequence (unconditional jump has been programmed, although the gating sequence was not closed with an Assign)
	13	"Close Parentheses" without "Open Parentheses" (a "Close Parentheses" command was programmed although no parentheses were open)
	14	Label within parentheses (a LBL instruction has been programmed, although parentheses are open)
	15	Label within a gating sequence (a LBL instruction has been programmed, although the previous gating was not closed with an Assign)
	16	Jump within parentheses (a jump instruction has been programmed, although parentheses are open)
	17	Parentheses are open at end of block (an EM instruction has been programmed, although parentheses are open)
	18	Label defined twice
	19	Word Assign missing (a Logic instruction has been programmed. although the previous Word-gating was not closed with an Assign)
	20	Logic Assign missing (a Word instruction has been programmed, although the previous Logic-gating was not closed with an Assign)
	21	Word accumulator not loaded (a Word Assign or gating has been programmed, although the Logic accumulator does not contain a definite value)
	22	Logic accumulator not loaded (a Logic Assign has been programmed, although the Logic accumulator does not contain a definite value)

Display (blinking)	Error Cause
ERROR IN PLC-PROGRAM XX (continued)	XX = 23 Accumulators not loaded on "Open Parentheses" (an A[, AN[, O[, ON[or XON[command has been programmed, although neither the Word nor the Logic accumulator has been gated or loaded) 24 Incorrect type of the parentheses result (a different type has been calculated in the parentheses from that which was defined at the "Open Parentheses" command, i.e. Logic instead of Word or vice versa) 25 Conditional jump with incorrect Logic accumulator (a conditional jump has been programmed, although the Logic accumulator does not contain a definite value) 26 Empty CASE-instruction 27 "END-CASE" missing

Notes

Screen Display (blinking error message)	**Error Cause**
GROSS POSITIONING ERROR <AXIS> A	**Position Monitoring (Servo Lag)** - Operation with feed pre-control: position monitoring range exceeded (range defined in machine parameter 1420) - Operation with servo lag: servo lag monitoring range exceeded (defined in machine parameter 1720)
GROSS POSITIOINING ERROR <AXIS> B	**Monitoring of the Analog Voltage Limit** - The nominal voltage calculated by the control has reached its limit of ± 10 V (only with feed precontrol).
GROSS POSITIONING ERROR <AXIS> C	**Movement Monitoring** - The voltage difference calculated by the control has reached the limit programmed in the machine parameter 1140.
GROSS POSITIONING ERROR <AXIS> D	**Standstill Monitoring** - The deviation from the nominal position of an axis in standstill has exceeded the value programmed in machine parameter 1110. - The nominal position was moved beyond during positioning (overshooting).
GROSS POSITIONING ERROR <AXIS> E	**Monitoring of Offset Voltage** - The offset voltage of 100 mV has been reached during an automatic offset adjustment with machine parameter 1220. (see section 16.5)
GROSS POSITIONING ERROR <AXIS> F	**Central Drive Monitoring** - An error in the configuration of the central drive has been detected (e.g. two analog outputs are active simultaneously).

Possible location of the error, when the error message "GROSS POSITIONING ERROR <AXIS> A/B/C/D/E/F" is generated:

When this error message is generated, the error may be located in any element of the closed loop.

e.g. - Control error (e.g. CLP board)
- Excessive offset voltage at the servo amplifier
- Monitoring function of the servo amplifier has responded (e.g. power monitoring)
- Servo amplifier defective
- Motor, tachometer, encoder or cables defective
- Mechanical defect (bearings, spindle, guides)
- Excessive mechanical forces on a drive

Screen Display (blinking error message)	**Error Cause**
MEASURING SYSTEM <AXIS> DEFECTIVE A **MEASURING SYSTEM <AXIS> DEFECTIVE B** **MEASURING SYSTEM <AXIS> DEFECTIVE C**	A = Signal amplitude error B = Signal frequency error C =Error with distance-coded scales Possible Reasons: - Encoder not connected - Cable damaged - Glass scale contaminated or damaged - Scanning head defective - Encoder monitoring system defective (CLP board) Encoder check: see section 11.3

Notes

Screen Display (blinking error message)	**Error Cause**
WRONG REFERENCE POINT	Wrong reference mark spacing entered with distance-coded linear encoders (counting error caused by the encoder or the LOGIC UNIT)
TNC-OPERATING TEMPERATURE EXCEEDED	The temperature inside the LOGIC UNIT has exceeded + 70°C.
EMERGENCY STOP DEFECTIVE	Error during the test routine for the output "Control Ready for Operation" when the machine is switched on (see section 17.4)
EMERGENCY STOP PLC	This error message is only generated, if one of the markers (M2924 - M3023) is set.
PLC: ERROR 00 1)	Marker 2924
to	to and marker 2815 set
PLC: ERROR 99 1)	Marker 3023
CHECK SUM ERROR 1A 2)	Wrong CRC sum NC EPROMs 1/2
CHECK SUM ERROR 1B 2)	Wrong CRC sum PLC-EPROM
CHECK SUM ERROR 1C 2)	Wrong CRC sum NC EPROMs 3/4

CRC = Cyclic Redundancy Check (during data transfer)

1) With customized PLC programs, a different dialog may be displayed instead of "PLC: ERROR 00 ...99". For further information, please contact your machine tool manufacturer.

2) If the error message **"CHECK SUM ERROR YX"** comes up repeatedly, please return the **complete logic unit** to HEIDENHAIN for repair. Indicate also the **check sum error**.

Notes

4. Hardware Components TNC 306/360

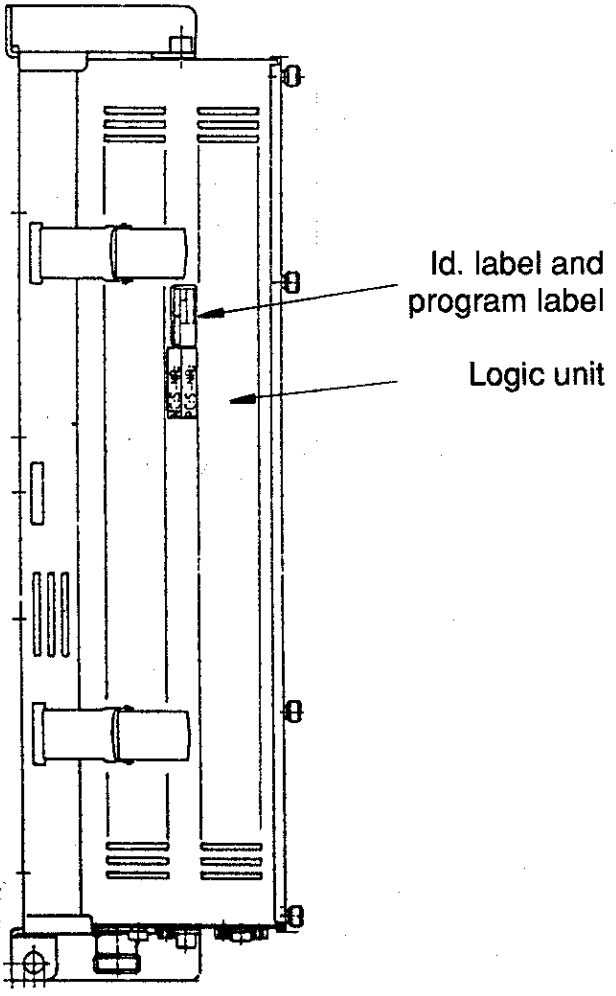
TNC Component	TNC 306[1]		TNC 360[2]	
	TNC 306 E	TNC 306 C	TNC 360	TNC 360 C
LOGIC UNIT LE 360				
Id.No. 258 991 --			x	
Id.No. 264 660 --			x	
Id.No. 264 085 --	x		x	
LOGIC UNIT LE 360 C				
Id.No. 270 641 --				x
Id.No. 270 642 --		x		x
VISUAL DISPLAY UNIT BE 212				
Id.No. 242 370 --	x		x	
FLAT SCREEN BF 110				
Id.No. 267 209 --		x		x
KEYBOARD TE 355 A/B				
Id.No. 255 015 --	x	x	x	x
Id.No. 255 016 --	x	x	x	x
PLC I/O BOARD PL 400 (Optional)				
Id.No. 255 855 --	x	x	x	x

1) EDM control
2) Milling control

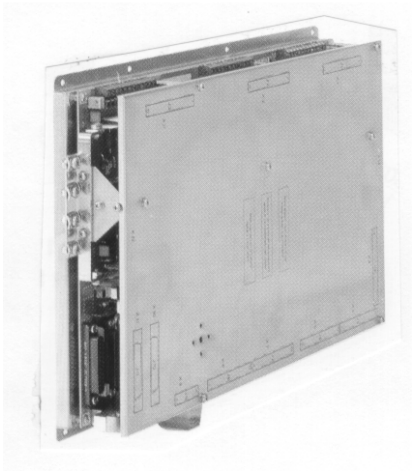
5. LOGIC UNIT LE 360/C

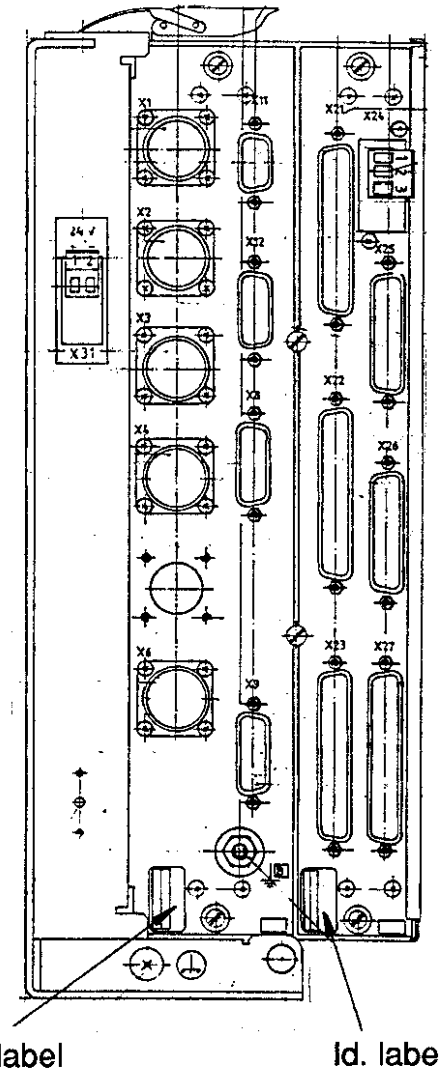
5.1 Designation of the LOGIC UNIT LE 360/C

Logic Unit LE 360/C without PLC I/O Board (PL 400)



The PLC I/O Board PL 400 is preferrably mounted to the top of the LE.





5.2 Hardware Components of the LOGIC UNIT LE 360/C

The LOGIC UNIT consists of the following components:

- Power supply
- Processsor board
- PLC board
- PLC I/O board PL 400 (optional)

5.2.1 Overview of Boards and Components

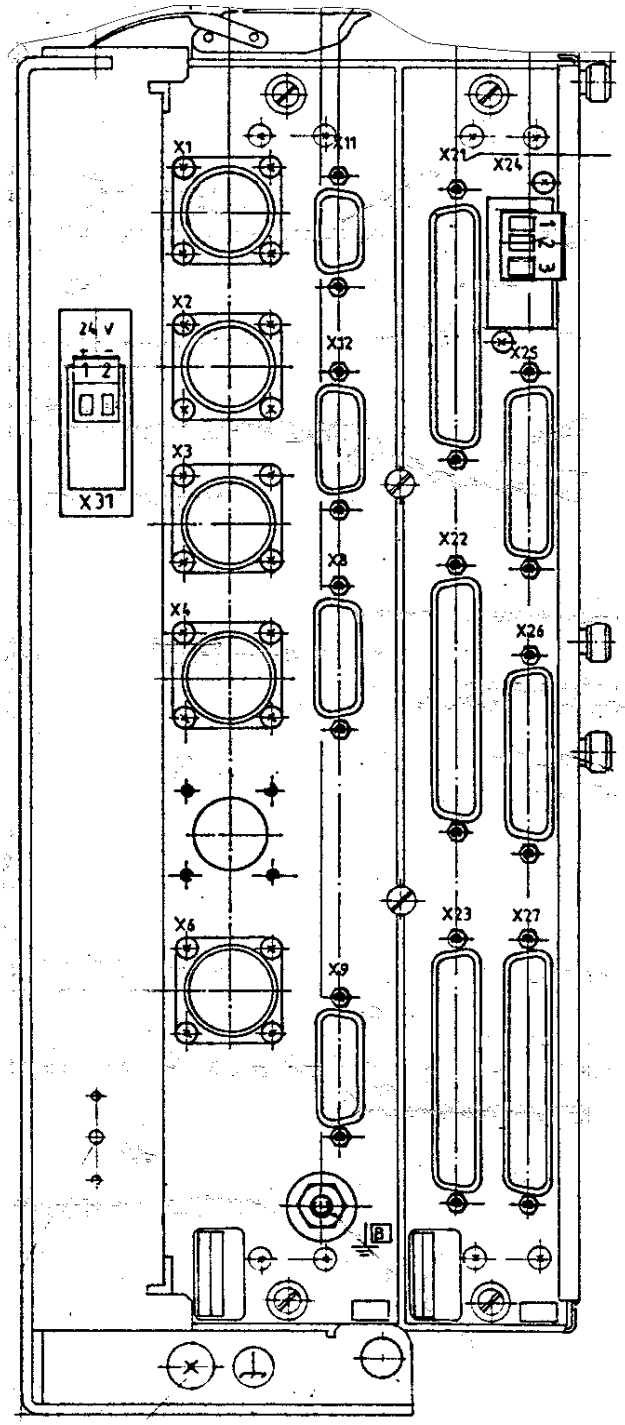
LE	LE 360			LE 360 C		
	258 991 --	264 660 --	264 085 --	270 641 --	270 642 1-	270 642 2-
PROCESSOR BOARD						
Id.No. 259 765 --	x					
Id.No. 263 728 --			x			
Id.No. 265 220 --		x				
Id.No. 268 559 --					x	
Id.No. 270 637 --				x		x
PLC BOARD						
Id.No. 259 850 --	x	x				
Id.No. 263 421 --			x	x	x	x
POWER SUPPLY						
Id.No. 236 484 --	x	x	x	x	x	x
PLC I/O BOARD (optional)						
Id.No. 255 855 --	x	x	x	x	x	x

6. Connector Designation and Pin Layout

6.1 Connectors on the LOGIC UNIT LE 360/C

6.1.1 Connector Designation: LOGIC UNIT LE 360/C

Power supply | Processor-board | PLC board



Processor board
X1 = encoder 1 (~)
X2 = encoder 2 (~)
X3 = encoder 3 (~)
X4 = encoder 4 (~)
X6 = encoder S (⎍⎍)
X8 = nominal value output 1, 2, 3, 4, S
X9 = VDU (BE or BF)
X11 = handwheel HR 130/330
X12 = touch probe system

B = signal ground

PLC board
X21 = PLC output
X22 = PLC input
X23 = TNC operating panel (TE)
X24 = power supply 24 V for PLC
X25 = data interface V.24/RS-232-C
X26 = PLC I/O board (PL 400)
X27 = machine operating panel (MB)

Power supply
X31 = power supply 24 V for LE

6.1.2 Pin Layout: POWER SUPPLY

X31 Power supply (NC)
Terminal block (pluggable) 2-pin

Pin No.	Assignment
1	+ 24 V
2	0V

6.1.3 Pin Layout : PROCESSOR BOARD

X1, X2, X3, X4,
Encoder 1, 2, 3, 4
Sine-wave input
Flange socket with female insert (9-pin)

Pin No.	Assignment
1	0°+
2	0°-
5	90°+
6	90°-
7	RI+
8	RI-
3	+ 5 (Up)
4	0 V (Un)
9	internal shield
Housing	external shield = housing

X6 Encoder S

Square-wave input
Flange socket with female insert (12-pin)

Pin No.	Signal
5	Ua1
6	-Ua1
8	Ua2
1	-Ua2
3	Ua0
4	-Ua0
7	UaS
2	+ 5V (sensor line)
12	+ 5V (Up)
11	0 V (sensor line)
10	0 V (Un)
9 (via spring)	shield = housing

X8 Nominal Value Output
1,2,3,4,S (TNC 360)
1,2,3,4 (TNC 306)
Flange socket with female insert (15-pin)

Pin No.	Signal
1	±10V analog output 1. axis
2	analog input (0 ... 4.999 V) max.
3	±10V analog output 2. axis
4	±10V analog output 5. axis
5	±10V analog output 3. axis
6	0V analog output 5. axis
7	±10V analog output 4. axis
8	±10V analog output S-axis
9	0V analog output 1. axis
10	0V analog input
11	0V analog input 2. axis
13	0V analog input 3. axis
14	0V analog input 4. axis
15	0V analog input S. axis
12	not assigned
Housing	external shield = housing

X9 Visual Display Unit

Flange socket with female insert (15-pin);
interface adjustment for BE 212 or
BF 110 via jumper

Pin No.	BE 212	BF 110 [1]
1, 8	0 V supply	-
2, 4	+ 12 V supply	-
3, 5, 6	do not assign	do not assign
7	-	Video
9	V SYNC	V SYNC
10	H SYNC	-
11	-	0 V signal
12	0 V signal	-
13	video	
14	-	H SYNC 2
15	-	CLOCK
Housing	external shield = housing	

[1] only with C versions

X11 Electronic Handwheel HR 130/HR 330

Flange socket with female insert (9-pin)

Pin No.	Signal Designation
1,3,5,7,9	do not assign
2	GND (0V)
4	+ 12 V
6	DTR
8	RxD
Housing	external shield

X12 Touch Probe System TS 120 (TS 111/TS 511, only via adaptor cable

Flange socket with female insert (15-pin)

Pin No.	Signal Designation
1	internal shield
3	ready for operation
4	start
5	+ 15 V
6	+ 5V (Up)
7	-battery warning
8	0 V (Un)
9	trigger signal
10	-trigger signal[1)]
2, 11 to 15	not assigned

[1)] Stylus at rest = high level

6.1.4 Pin Layout: PLC Board

X44 Power Supply (PLC part)

Terminal block (pluggable) 3-pin

Pin No.	Assignment
1	+ 24 V_A can be switched off with EMERCENCY STOP
2	+ 24 V cannot be switched off with EMERGENCY STOP
3	0 V

X23 TNC Operating Panel (TE)

Flange socket with female insert (37-pin)

Pin No.	Assignment		
1	RL0		for key matrix
2	RL1		
3	RL2		
4	RL3		
5	RL4		
6	RL5		
7	RL6		
8	RL7		
9	do not assign		
10	do not assign		
11	do not assign		
12	do not assign		
13	do not assign		
14	do not assign		
15	do not assign		
16	do not assign		
17	do not assign		
18	do not assign		
19	do not assign		

20	SL0		for key matrix
21	SL1		
22	SL2		
23	SL3		
24	SL4		
25	SL5		
26	SL6		
27	SL7		
28	do not assign		
29	do not assign		
30	do not assign (internally on 0 V)		
31	do not assign		
32	do not assign		
33	do not assign		
34	spindel override (wiper)		
35	feed override (wiper)		
36	+ 5 V override potentiometer		
37	0 V override potentiometer		
housing	external shield		

X21: PLC Output

Flange socket with female insert (37-pin)

Pin No.	Assignment
1	O0
2	O1
3	O2
4	O3
5	O4
6	O5
7	O6
8	O7
9	O8
10	O7
11	O10
12	O11
13	O12
14	O13
15	O14
16	O15
17	O16
18	O17
19	O18
20	O19
21	O20
22	O21
23	O22
24	O23
25	O24[2)]
26	O25[2)]
27	O26[2)]
28	O27[2)]
29	O28[2)]
30	O29[2)]
31	O30[2)]
32	do not assign
33	0 V (PLC)[1)]
34	control ready for operation[2)]
35,36,37	+ 24 V_A PLC [3)]
housing	external shield

X22: PLC Input

Flange socket with female insert (37-pin)

Pin No.	Assignment
1	I0
2	I1
3	I2
4	I3 acknowledgement for test "Control Ready for Operation"
5	I4
6	I5
7	I6
8	I7
9	I8
10	I9
11	I10
12	I11
13	I12
14	I13
15	I14
16	I15
17	I16
18	I17
19	I18
20	I19
21	I20
22	I21
23	I22
24	I23
25	I24
26	I25
27	I26
28	I27
29	I30
30	I29
31	I30
32	I31
33,34	do not assign
35,36,37	0V PLC[1)]
housing	external shield

1) 0 V PLC reference potential for testing
2) Cannot be switched off with EMERGENCY STOP
3) + 24 V_A power supply for PLC testing (can be switched off)

X25 Data Interface V.24/RS-232
Flange socket with female insert (25-pin)

Pin No.	Assignment
1	shield
2	RxD
3	TxD
4	CTS
5	RTS
6	DTR
7	GND (0 V * 2)
8 bis 19	not assigned
20	DSR
21 bis 25	not assigned
housing	external shield

X26 PLCI/O Board (PL)
Flange socket with male insert (25-pin)

Pin No.	Assignment
1, 2, 3	0 V * 1
4, 5, 6, 17, 18	not assigned
7	-RESET
8	-WRITE EXTERN
9	WRITE EXTERN
10	-A5
11	-A3
12	-A1
13	shield
14, 15, 16	+ 12 V * 1
19	serial IN 1
20	EMERGENCY STOP
21	-serial OUT
22	serial OUT
23	-A4
24	-A2
25	-A0

X27 Machine Operating Panel
Flange socket with female insert (37-pin)

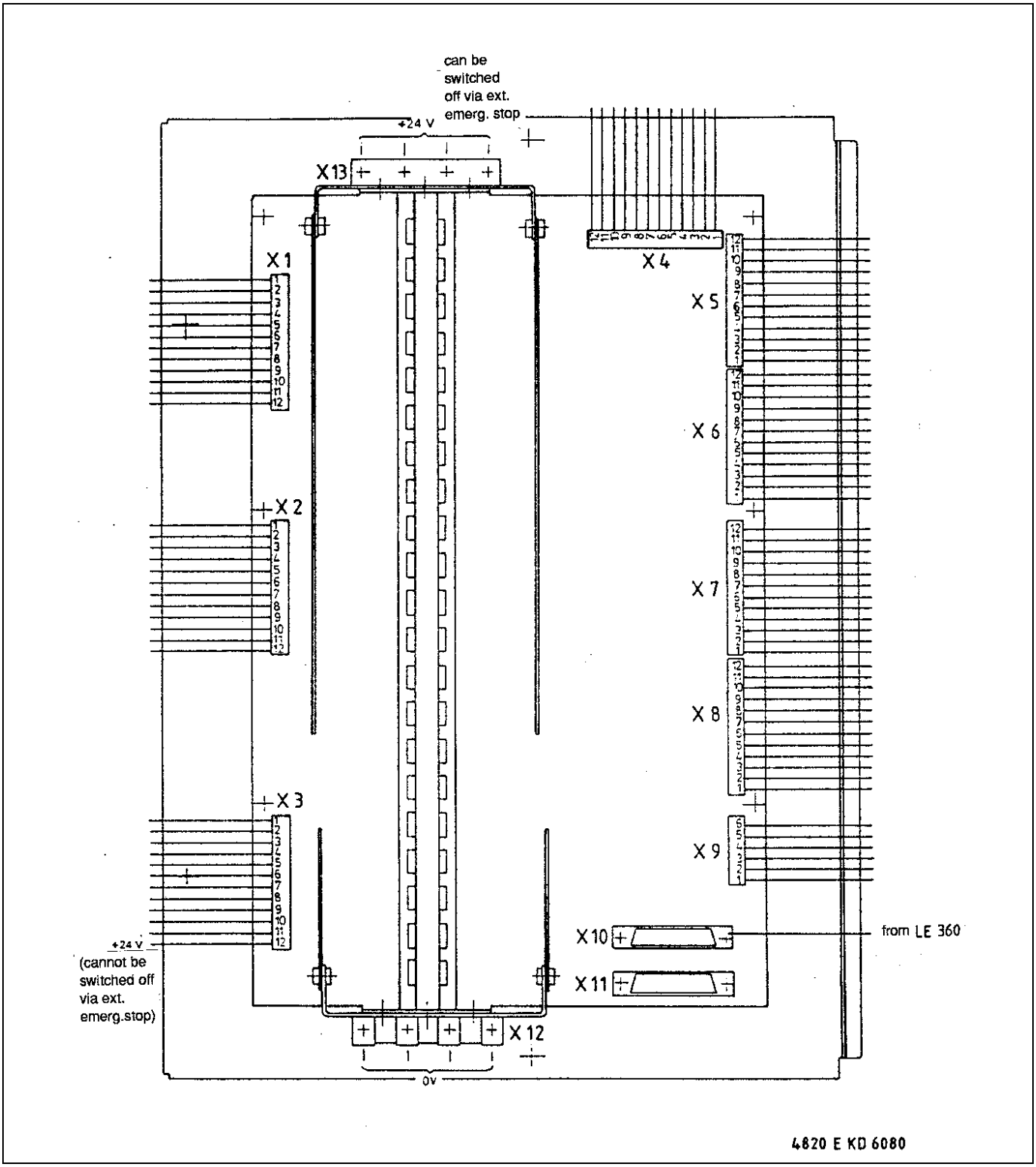
Pin No.	Assignment
1	I128
2	I129
3	I130
4	I131
5	I132
6	I133
7	I134
8	I135
9	I136
10	I137
11	I138
12	I139
13	I140
14	I141
15	I142
16	I143
17	I144
18	I145

Pin No.	Assignment
19	I146
20	I147
21	I148
22	I149
23	I150
24	I151
25	do not assign
26	O0 [1]
27	O1 [1]
28	O2 [1]
29	O3 [1]
30	O4 [1]
31	O5 [1]
32	O6 [1]
33	O7 [1]
34	0 V (PLC) [2]
35	0 V (PLC) [2]
36	+ 24 V_A PLC [3]
37	+ 24 V_A PLC [3]

[1] O0...O7 simultaneously to X21 (PLC output)
[2] 0V PLC reference potential for testing
[3] PLC voltage supply + 24V_A routed via fuse for the inputs (can be switched off)

6.2 Connectors on the PLC I/O Board

6.2.1 Connector Designation: PLC I/O Board PL 400



6.2.2 Pin Layout: PLC I/O Board PL 400

X1 Pin No.	Assignment PL 400
1	O32
2	O33
3	O34
4	O35
5	O36
6	O37
7	O38
8	O39
9	O40
10	O41
11	O42
12	do not assign

X4 Pin No.	Assignment PL 400
1	I126
2	I74
3	I73
4	I72
5	I71
6	I70
7	I69
8	I68
9	I67
10	I66
11	I65
12	I64

X2 Pin No.	Assignment PL 400
1	O43
2	O44
3	O45
4	O46
5	O47
6	O48
7	O49
8	O50
9	O51
10	O52
11	O53
12	do not assign

X5 Pin No.	Assignment PL 400
1	I86
2	I85
3	I84
4	I83
5	I82
6	I81
7	I80
8	I79
9	I78
10	I77
11	I76
12	I75

X3 Pin No.	Assignment PL 400
1	O54
2	O55
3	O56
4	O57
5	O58
6	O59
7	O60
8	O61
9	O62
10	control ready for operation
11	do not assign
12	+ 24 V cannot be switched off via EMERGENCY STOP

X6 Pin No.	Assignment PL 400
1	I98
2	I97
3	I96
4	I95
5	I94
6	I93
7	I93
8	I91
9	I90
10	I89
11	I88
12	I87

[1] + 24 V must always be connected, even if the outputs are not used.

X7 Pin No.	Assignment PL 400
1	I110
2	I109
3	I108
4	I107
5	I106
6	I105
7	I104
8	I103
9	I102
10	I101
11	I100
12	I99

X8 Pin No.	Assignment PL 400
1	I122
2	I121
3	I120
4	I119
5	I118
6	I117
7	I116
8	I115
9	I114
10	I113
11	I112
12	I111

X9 Pin No.	Assignment PL 400
1	do not assign
2	do not assign
3	do not assign
4	I125
5	I124
6	I123

X10 Connection to LE Pin No.	Assignment
1,2,3	0 V
4	serial IN 2
5,6,17,18	not assigned
7	-RESET
8	-WRITE EXTERN
9	WRITE EXTERN
10	-A5
11	-A3
12	-A1
13	shield
14,15,16	+ 12 V
19	serial IN 1
20	EMERGENCY STOP
21	-SERIAL OUT
22	SERIAL OUT
23	-A4
24	-A2
25	-A0

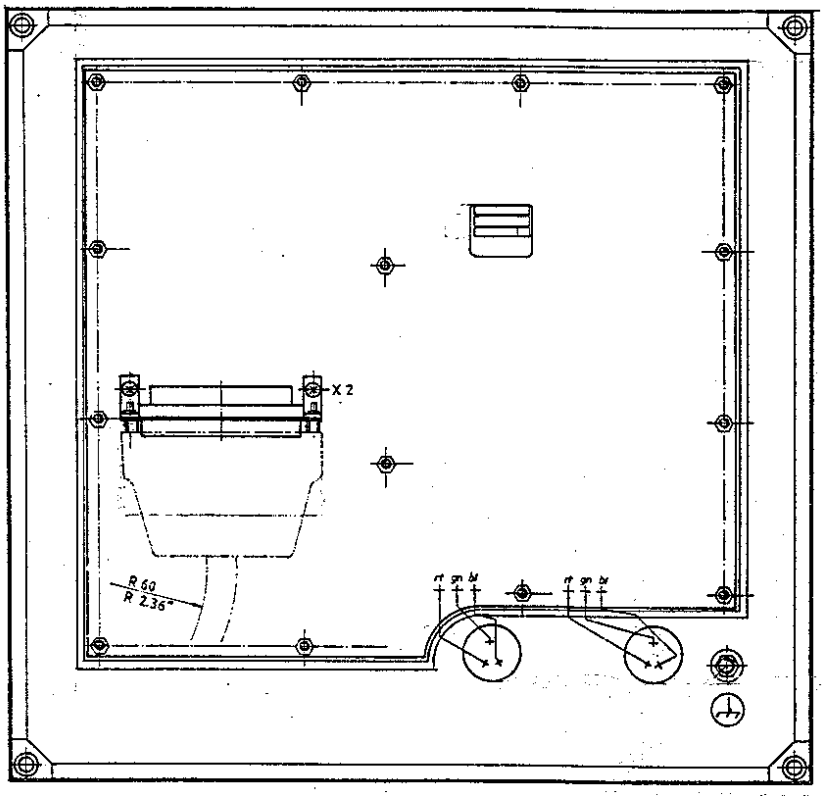
Note:

The LE 360/C is **not** prepared for a 2nd PL 400 to be connected!

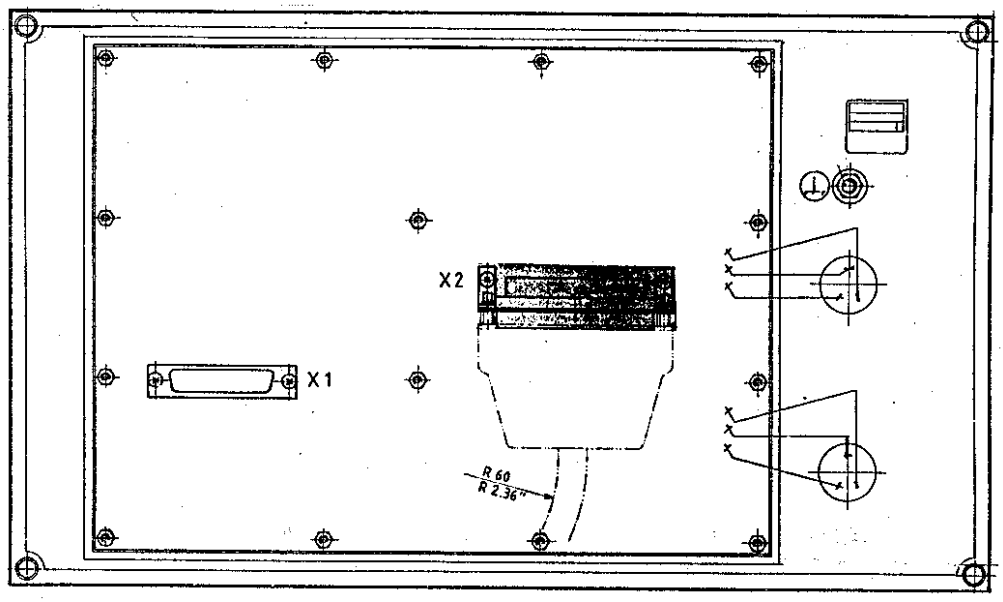
6.3 Connectors on the Keyboard Units TE 355 A/B

6.3.1 Connector Designation: TE 355 A/B

TE 355 A (tall version)



TE 355 B (wide version)



(X1 is not used)

6.3.2 Pin Layout: Keyboard Unit TE 355 A/B

X2: Connection to the Logic Unit (LE)

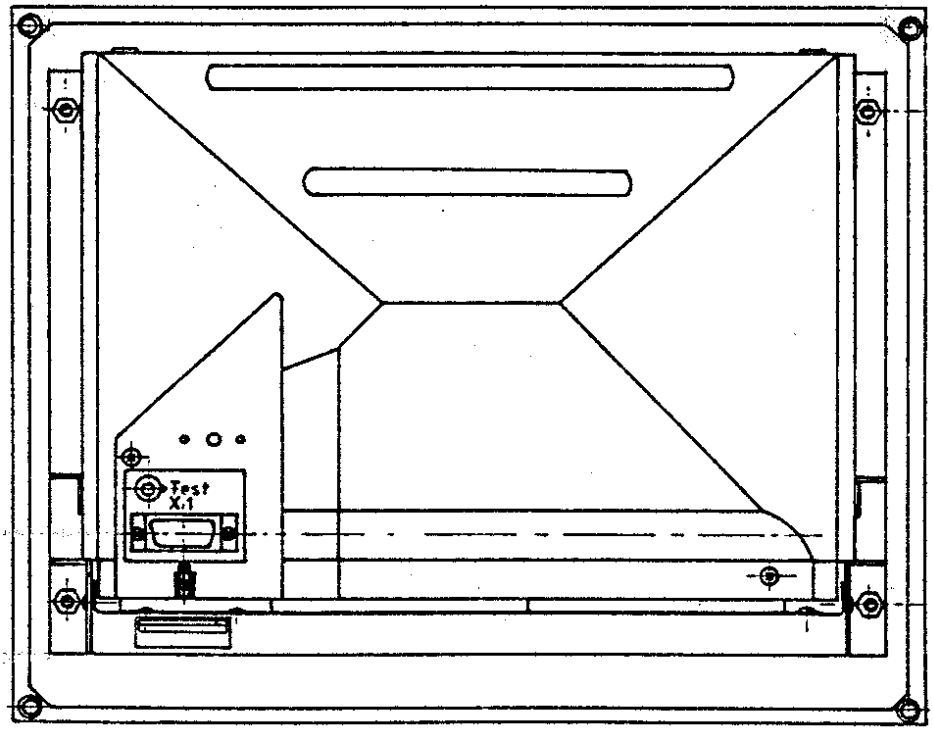
Flange socket with male insert (37-pin)

Pin No.	Assignment		
1	RL0		for key matrix
2	RL1		
3	RL2		
4	RL3		
5	RL4		
6	RL5		
7	RL6		
8	RL7		
9	do not assign		
10	do not assign		
11	do not assign		
12	do not assign		
13	do not assign		
14	do not assign		
15	do not assign		
16	do not assign		
17	do not assign		
18	do not assign		
19	do not assign		
20	SL0		for key matrix
21	SL1		
22	SL2		
23	SL3		
24	SL4		
25	SL5		
26	SL6		
27	SL7		
28	do not assign		
29	do not assign		
30	do not assign (internally on 0V)		
31	do not assign		
32	do not assign		
33	do not assign		
34	spindle override (wiper)		
35	feed override (wiper)		
36	+ 5 V for override potentiometer		
37	0 V for override potentiometer		

6.4 Connectors on the Visual Display Units

6.4.1 Connectors on the Visual Display Unit BE 212

6.4.1.1 Connector Designation



6.4.1.2 Pin Layout

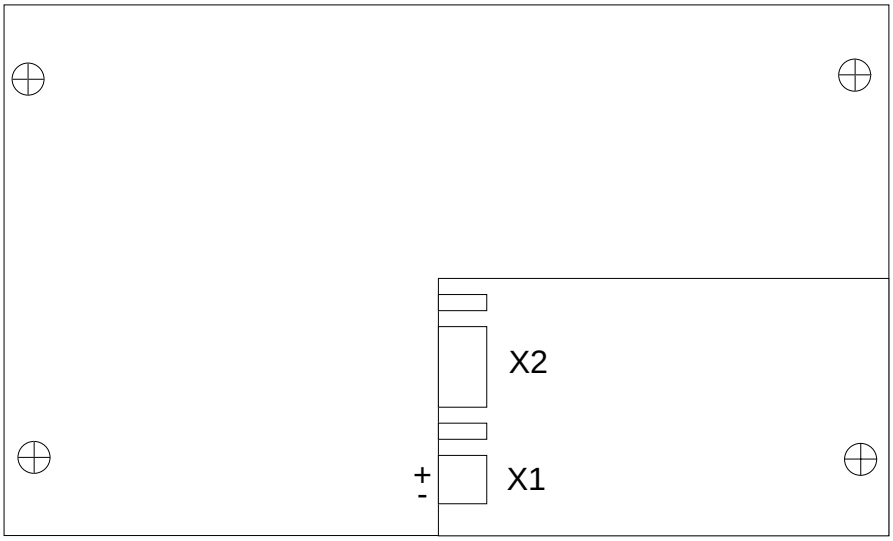
X1: Connection to the Logic Unit (LE)

Flange socket with male insert (15-pin)

Pin No.	Signal
1 and 8	0V supply
2 and 4	+ 12 V supply
3,5,6,7	not assgined
9	V SYNC
10	H SYNC
11	not assigned
12	0V signal
13	VIDEO
14,15	not assigned
housing	external shield = housing

6.4.2 Connectors on the Flat Screen BF 110

6.4.2.1 Connector Desgination



6.4.2.2 Pin Layout

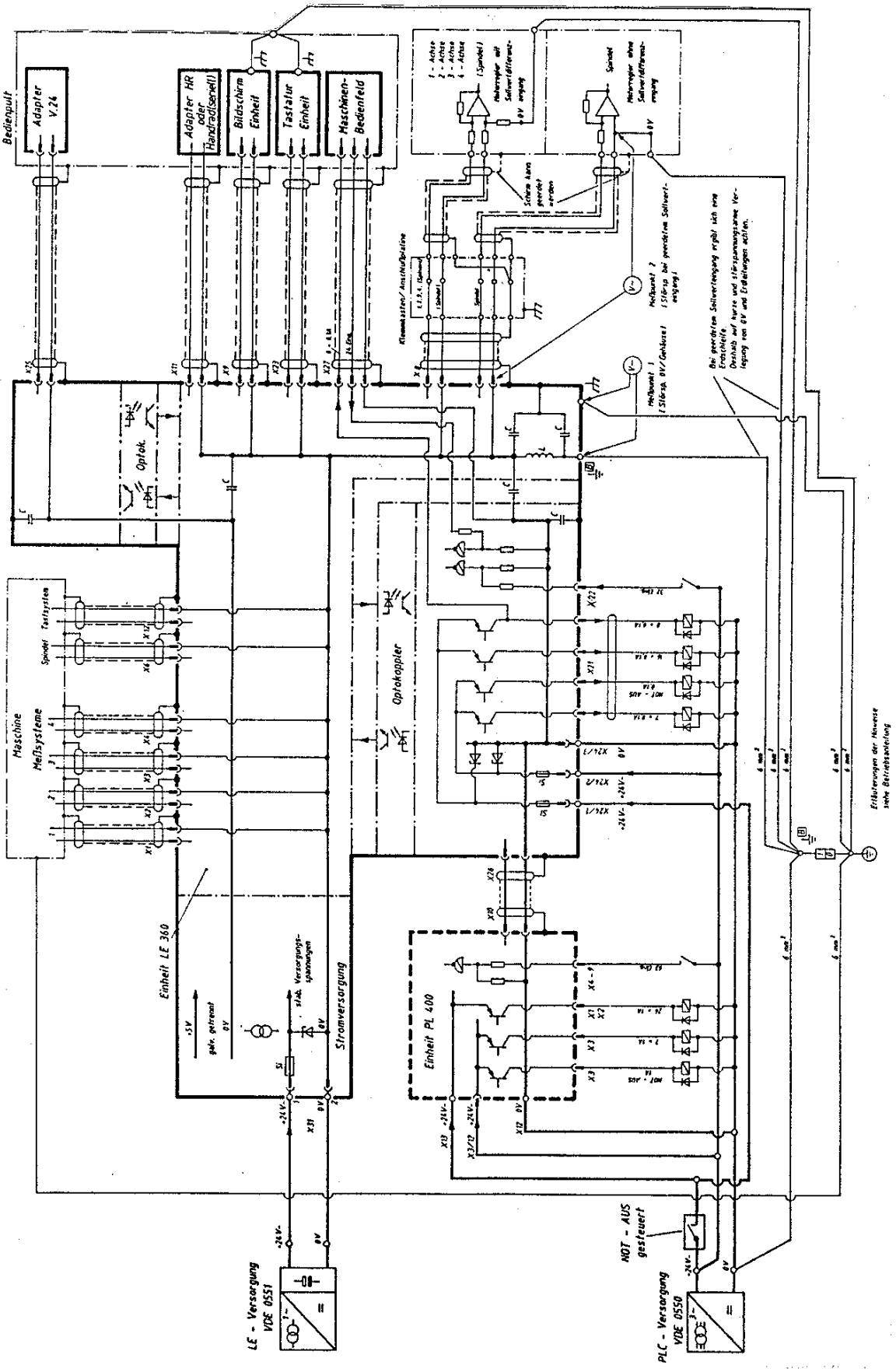
X1: Power Supply for the Flat Screen
Terminal block (pluggable), 2-pin

Pin No.	Signal
-	0V supply
+	+ 24V supply

X2: Connection to the Logic Unit (LE)
Flange socket with male insert (15-pin)

Pin No.	Signal
1 - 6	not assiged
7	video (P0)
8	not assigned
9	V SYNC
10	not assigned
11	0V signal
12 - 13	not assigned
14	H SYNC
15	clock
housing	external shield = housing

7. Grounding Diagram



8. Power Supply

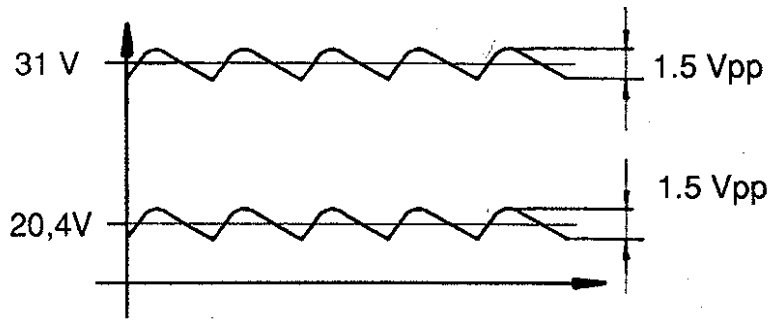
8.1 External Power Supply Requirements

The voltages must correspond to the following definitions:

Unit		Supply Voltage	Voltage Range D.C. Average Value	Max. Current Consumption	Power Consumption
LE	NC	24V (VDE 0551)	lower limit 20.4 V ⎓	LE 360: 1.2A to 1.5A	28.8W to 36W
	PLC	24 V (VDE 0550)	upper limit 31 V ⎓ [1)]	1.8A if half of the inputs/ outputs are active simultaneously	approx. 6W if approx. 1/3 of the inputs/outputs are active simultaneously
PL 400				21A if half of the inputs/ outputs are active simultaneously	approx. 25W if approx. 1/3 of the inputs/outputs are active simultaneously
BF 110				0.85A with full utilization of the VDU	approx. 20 W

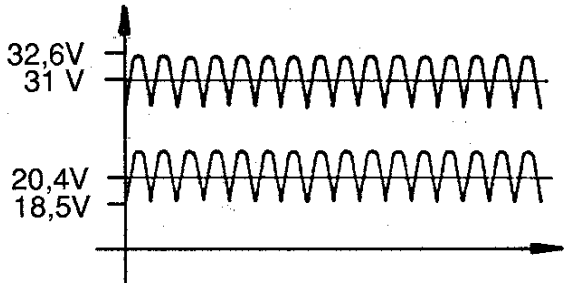
8.1.1 NC Power Supply

The NC-part of the LE must not be connected to the control voltage of the machine tool! It requires its own external power supply generated separately according to the German Standard VDE 0551:
D.C. voltage of 24 V with a permissible A.C. component (ripple voltage) of max. 1.5 Vpp (recommended filtering capacitor 10000 µF/40 V-).



8.1.2 PLC Power Supply

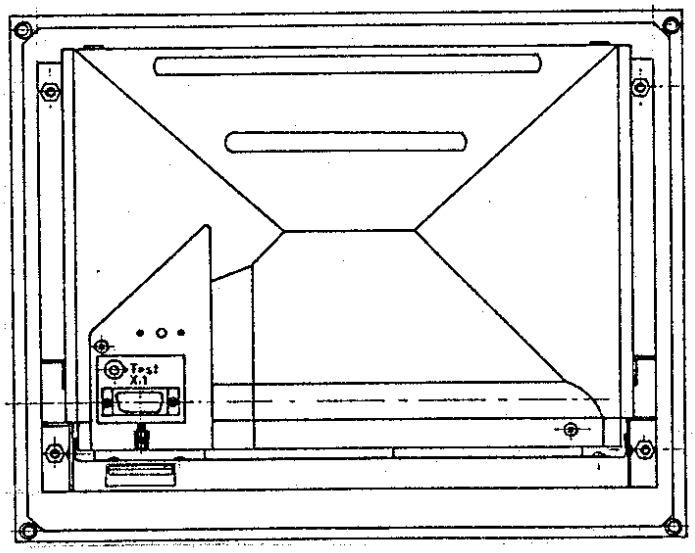
The PLC part (PLC inputs and outputs) of the LE and the PL 400 is operated with a control voltage of 24 V (of the machine tool), generated according to VDE 0550 (German standard).
Superimposed A.C. voltage components, arising from an non-controlled three-phase bridge connection with a ripple factor of 5% (see German standard DIN 40110/10.75, section 1.2) are permissible. Thus, the highest absolute value for the upper voltage limit is 32.6 V; the smallest absolute value for the lower voltage limit is 18.5 V.



The 0 V line of the PLC power supply must be connected to the central signal ground of the machine tool (ground line $\varnothing \geq 6mm^2$)

8.2 Power Supply of the Visual Display Units

The BE 212 screen is supplied with a D.C. voltage of +12V via connector X1, flange socket with male insert (15-pin).

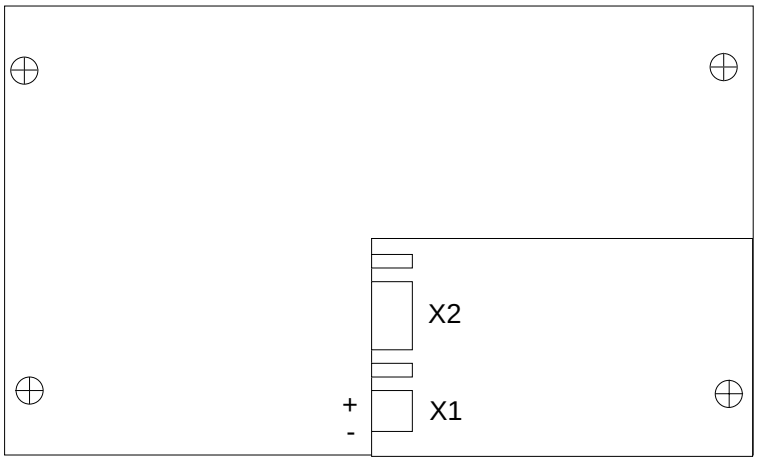


X1: Connection to LOGIC UNIT

Flange socket with male insert (15-pin)

Pin No.	Signal
1 and 8	0V supply
2 and 4	+ 12 V supply
3,5,6,7	not assigned
9	V SYNC
10	H SYNC
11	not assigned
12	0V signal
13	VIDEO
14,15	not assigned
housing	external shield=housing

The BF 110 flat screen is supplied via the 2-pin terminal block X1.



X1: Power Supply

Pin No.	Assignment
1	+ 12 V [1)]
2	0V

[1)] Definition see section 8.1

8.3 Power Supply of the NC Part

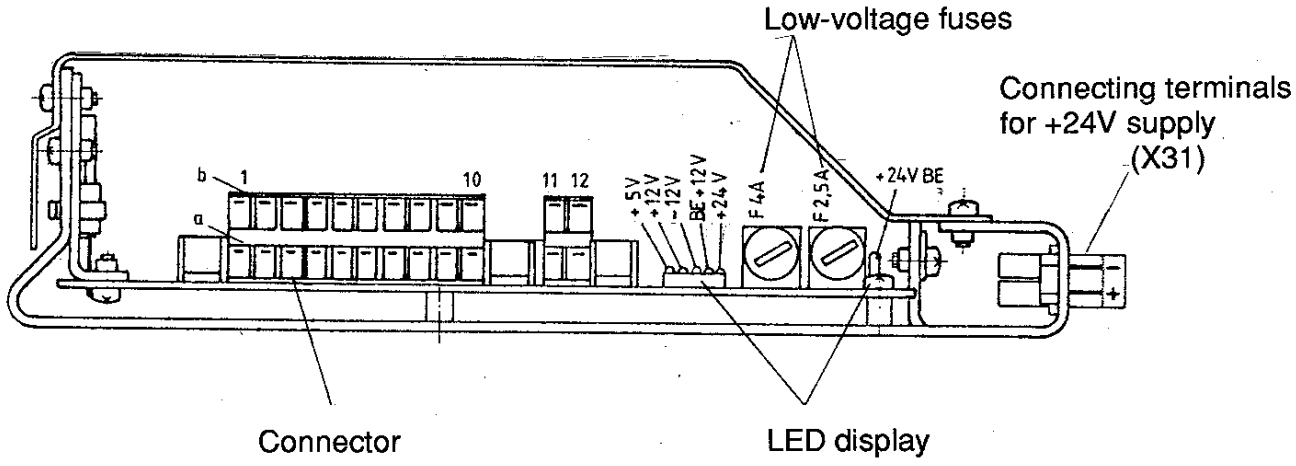
The power supply line for the NC is connected to the terminals of X31.

The different voltages for the LE are transformed from the voltage fed (+24V) in the "POWER SUPPLY" assembly (see block diagram, sec. 8.3.1).

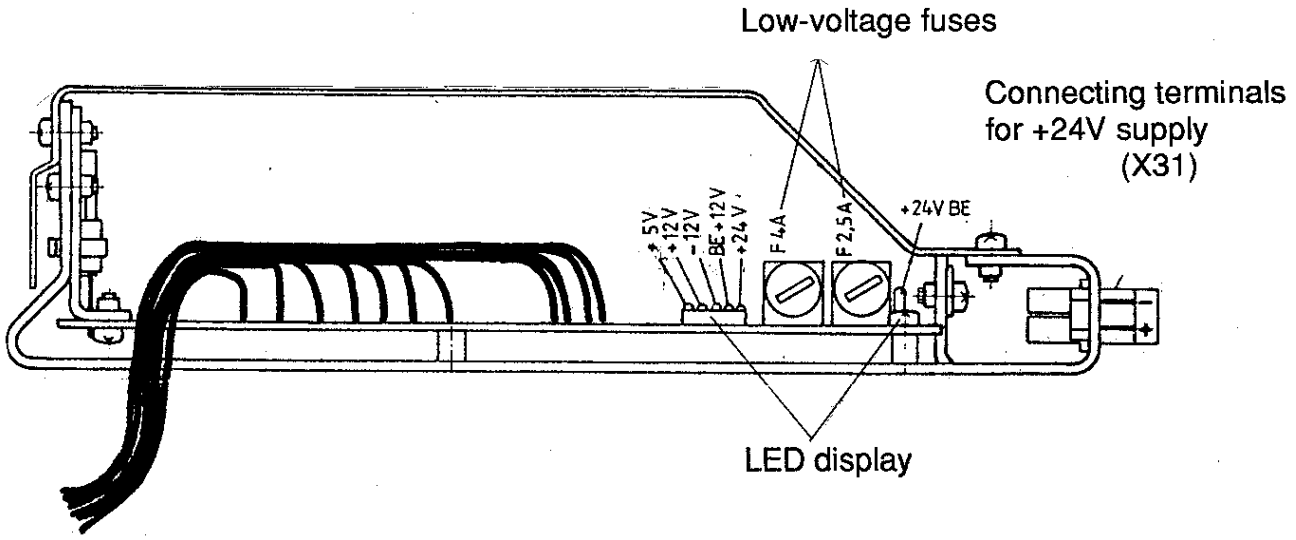
The input and output voltages are displayed by LEDs.
The states of the individual voltages are only displayed approximately by the LEDs. For exact values please see section 8.4, Power Supply Check.

Two power supply versions are used:

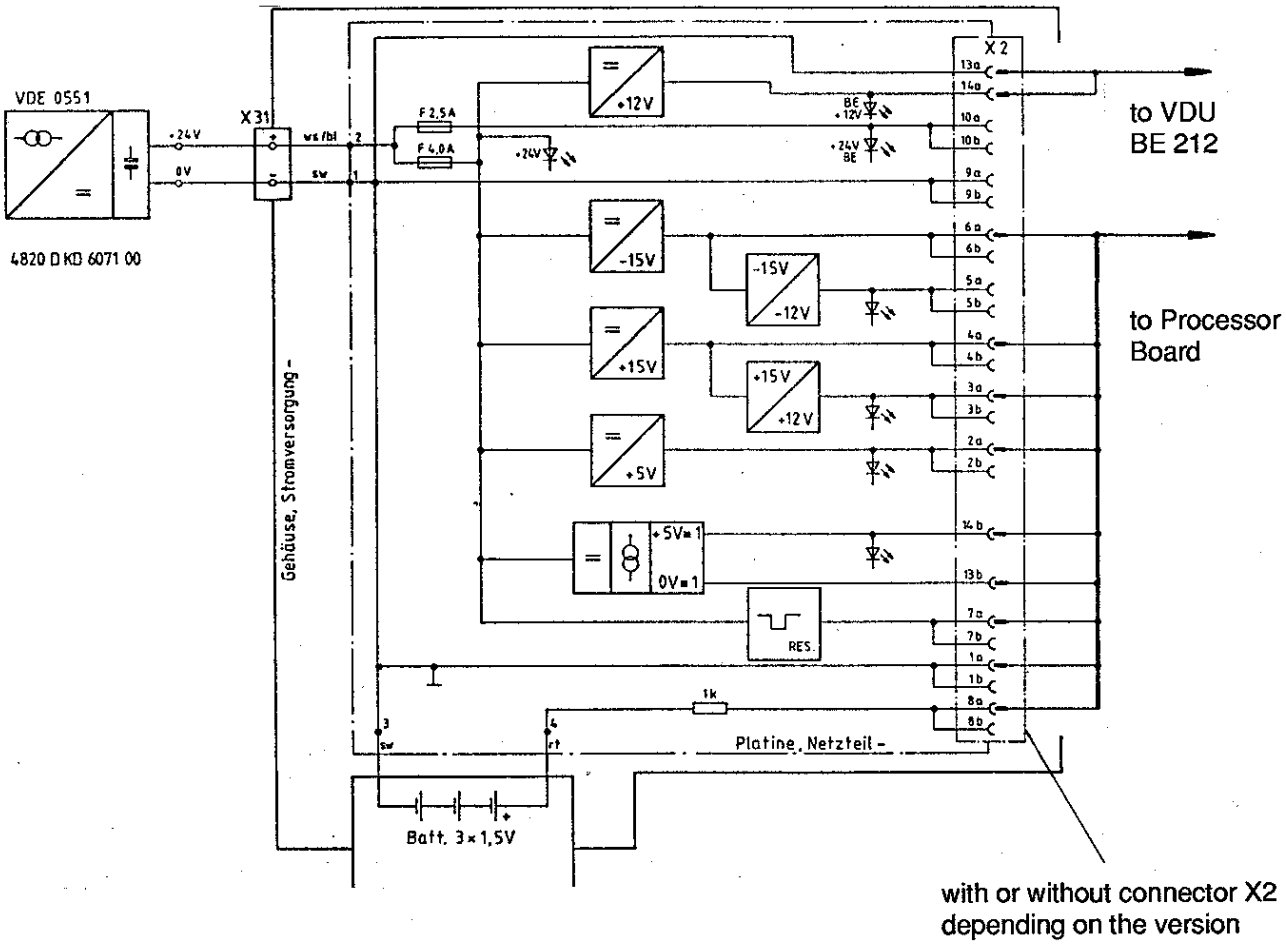
a) Connection to the processor board via connector.



b) Direct connection to the processor board via soldered terminals.



8.3.1 Power Supply for LE 360/C



8.3.2 Voltage Value Table

Measuring Point on the Power Supply Board	Reference Point on the Power Supply Board	Output	U_{NOM} [V]	U_{MIN} [V]	U_{MAX} [V]	I_{NOM} [A]
LH 22	LH24	+ 5V (UP)	+5.05	+ 5.00	+ 5.10	2.5
LH 20	LH 24	+ 12V	+ 12	+ 11.4	+ 12.6	0.1
LH 18	LH 24	+ 15V	+ 15.0	+ 14.4	+ 15.6	0.15
LH 14	LH 24	- 15V	- 15.0	- 14.4	- 15.6	0.08
LH 10	LH 24	U_{BATT}	+ 4.5	+ 3.9	-	ca. 20 µA
LH 2	LH4	+ 12V BE	+ 12.3	+ 12	+ 12.6	1.3
LH1	LH3	+ 5V* 1 [1]	+ 5	+4.75	+ 5.25	0.3

[1] potential-free
reset U_{Lmax} = 0.4V, U_{Hmin} = 3.9V

8.4 Checking the Power Supply (Power Supply Unit)

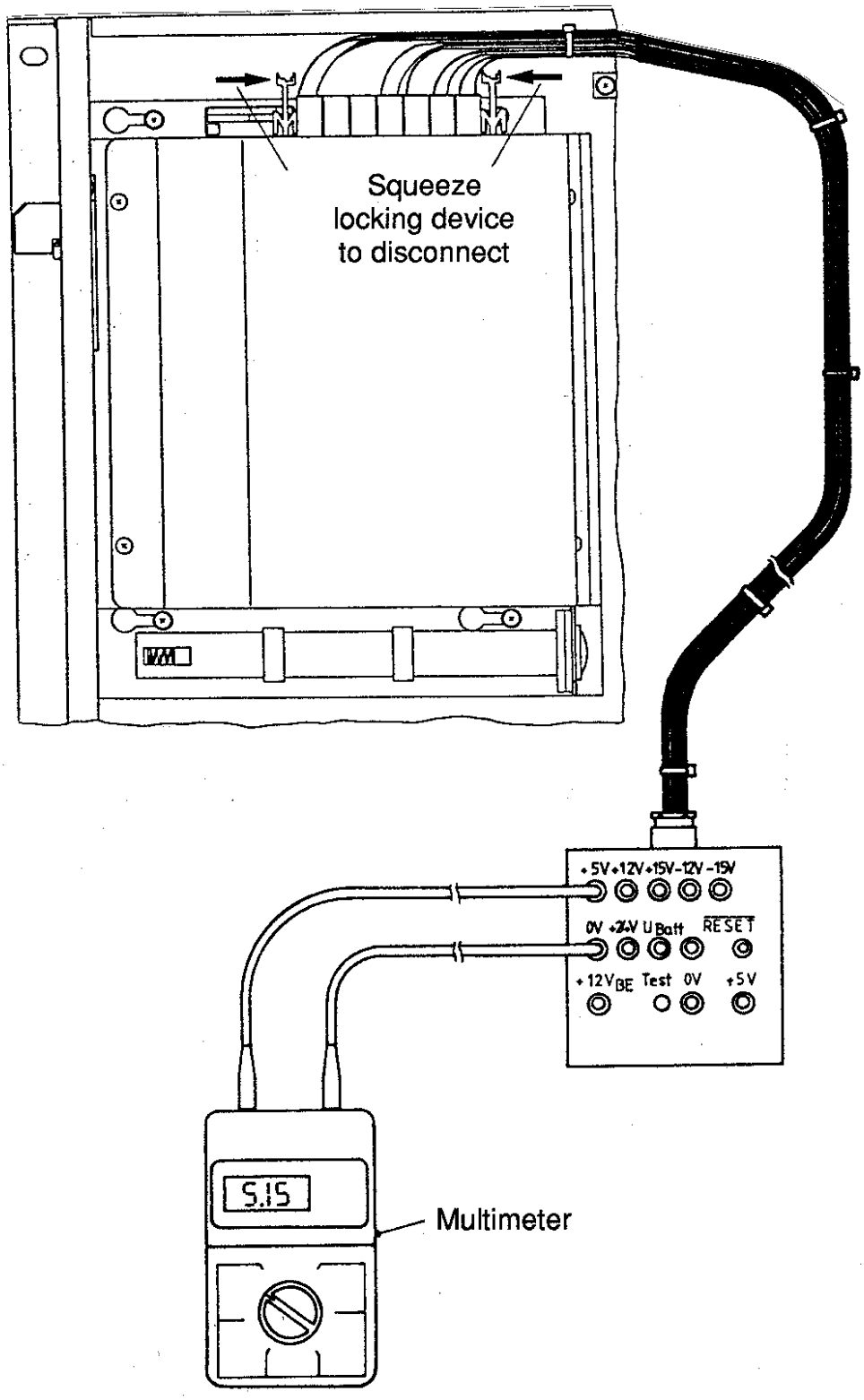
Two low-voltage fuses are located on the "POWER SUPPLY" assembly. The fuse F 2.5A protects the output voltage of +24V BE (not used with TNC 306/360) and the fuse F 4.0A protects the remaining voltages (see block diagram, sec. 8.3.1). If an error occurs in the power supply (all voltages are missing), first check the +24V at the supply line (2-pin terminal block X31) and then the low-voltage fuse F4.0A.

By means of the TEST LOAD unit, the power supply can be checked fast and easily. For this purpose the connector X2[1)] leading to the processor board must be disconnected from the power supply and connected to the TEST LOAD unit.
The different values can be measured at the sockets of the TEST LOAD unit with a multimeter. The values and their tolerances can be seen from the table in section 8.3.2.
If no TEST LOAD unit is available, the voltages can be measured at the measuring points on the processor board (see sec. 8.4.3).
The values and their tolerances can be seen from the corresponding tables. If the measured values deviate distinctly from the values in the table, the "power supply" assembly is defective.

Attention!
Always switch off the main switch when engaging or disengaging any connectors.
The power supply unit does not function during free run.
(basic load is required)

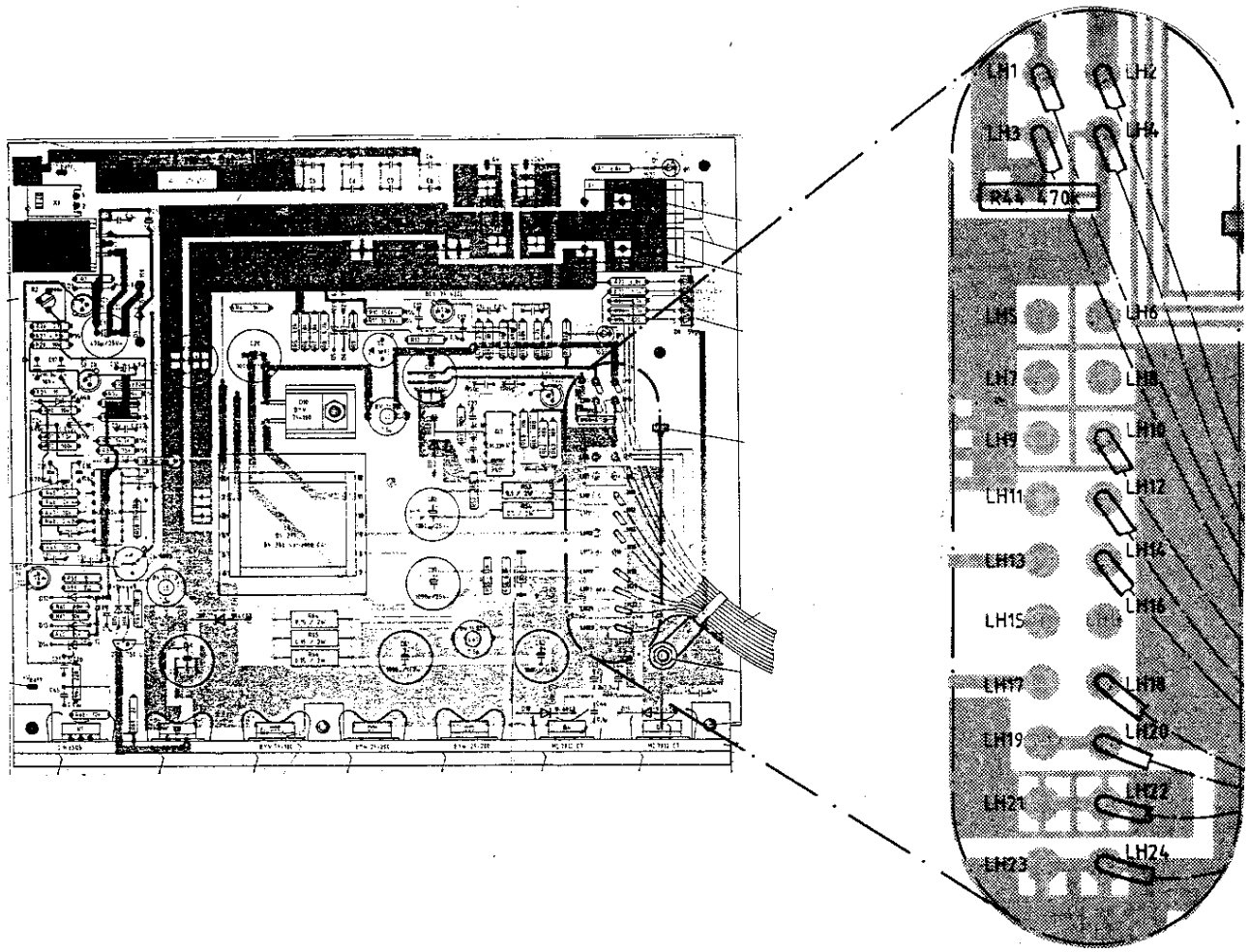
1) If you are using power supply units without connectors, no TEST LOAD unit can be used. In this case, the voltages can be measured on the processor board (see sec. 8.4.3) or on the power supply board (see sec. 8.4.2).

8.4.1 Measurement Setup with the TEST LOAD Unit (for Power Supply Units with Connector X2)



If you are using power supply units without connector X2 the test load unit cannot be used. In this case, the power supply unit must be tested as described in section 8.4, foot note [1)].

8.4.2 Measuring Points on the Power Supply Board (for Power Supply Units without Connector X2)

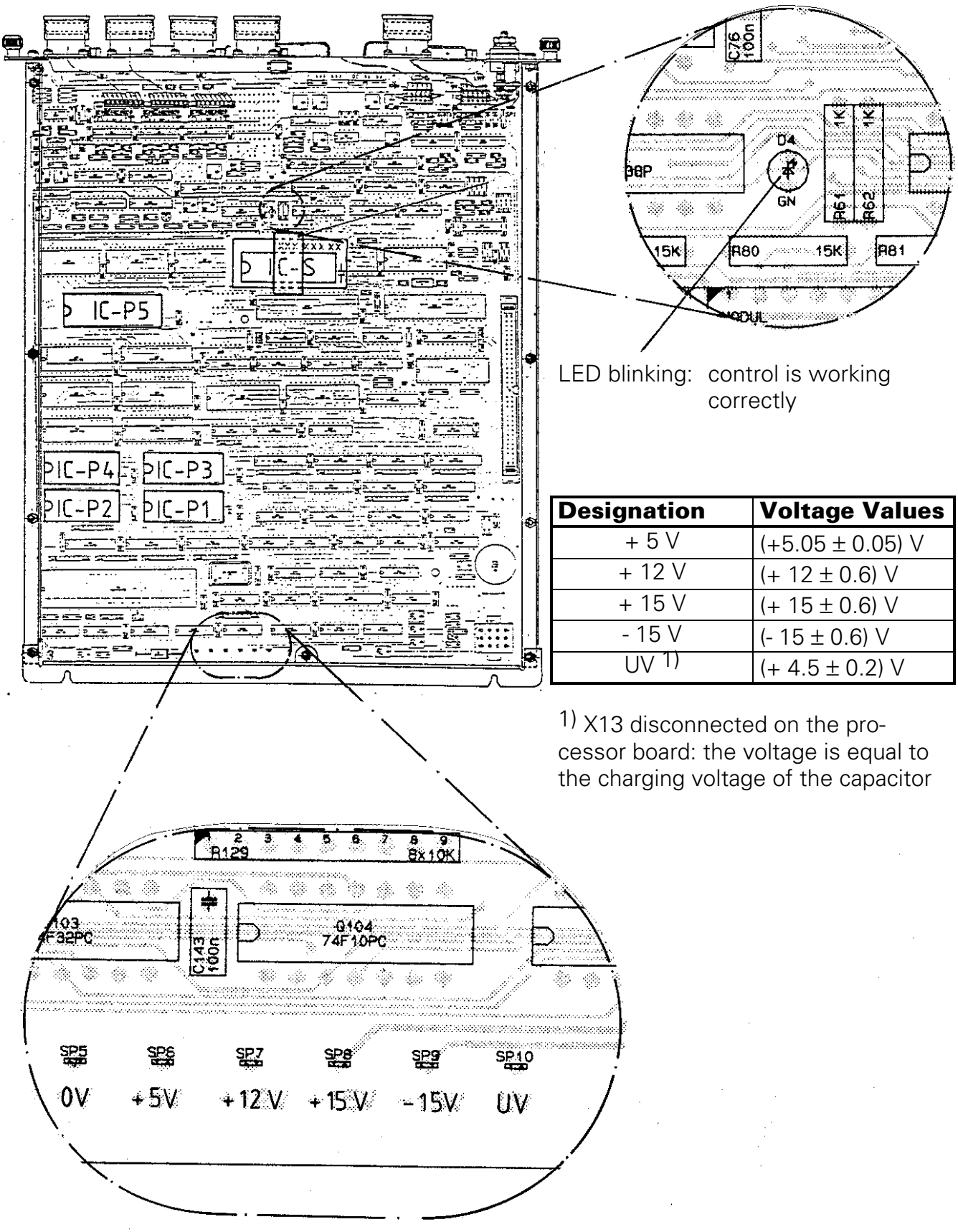


Voltage Value Table

Measuring Point on the Power Supply Board	Reference Point on the Power Supply Board	Output	U_{NOM} [V]	U_{MIN} [V]	U_{MAX} [V]	I_{NOM} [A]
LH 22	LH24	+ 5V (UP)	+5.05	+ 5.00	+ 5.10	2.5
LH 20	LH 24	+ 12V	+ 12	+ 11.4	+ 12.6	0.1
LH 18	LH 24	+ 15V	+ 15.0	+ 14.4	+ 15.6	0.15
LH 14	LH 24	- 15V	- 15.0	- 14.4	- 15.6	0.08
LH 10	LH 24	U_{BATT}	+ 4.5	+ 3.9	-	ca. 20 µA
LH 2	LH4	+ 12V BE	+ 12.3	+ 12	+ 12.6	1.3
LH1	LH3	+ 5V* 1 [1)]	+ 5	+4.75	+ 5.25	0.3

1) potential-free
reset U_{Lmax} = 0.4V, U_{Hmin} = 3.9V

8.4.3 Measuring Points on the Processor Board



LED blinking: control is working correctly

Designation	Voltage Values
+ 5 V	(+5.05 ± 0.05) V
+ 12 V	(+ 12 ± 0.6) V
+ 15 V	(+ 15 ± 0.6) V
- 15 V	(- 15 ± 0.6) V
UV [1]	(+ 4.5 ± 0.2) V

[1] X13 disconnected on the processor board: the voltage is equal to the charging voltage of the capacitor

8.5 Power Supply of the PLC

The power supply line for the internal PLC is connected to the terminal block X24 (1 = +24V_A can be switched off, 2 = +24V cannot be switched off, 3 = 0V).

The PLC supply voltages are protected with low-voltage fuses on the PLC graphics board.

+24V_A can be switched off low-voltage fuse F 2.5A
+24V cannot be switched off low-voltage fuse F 1.0A

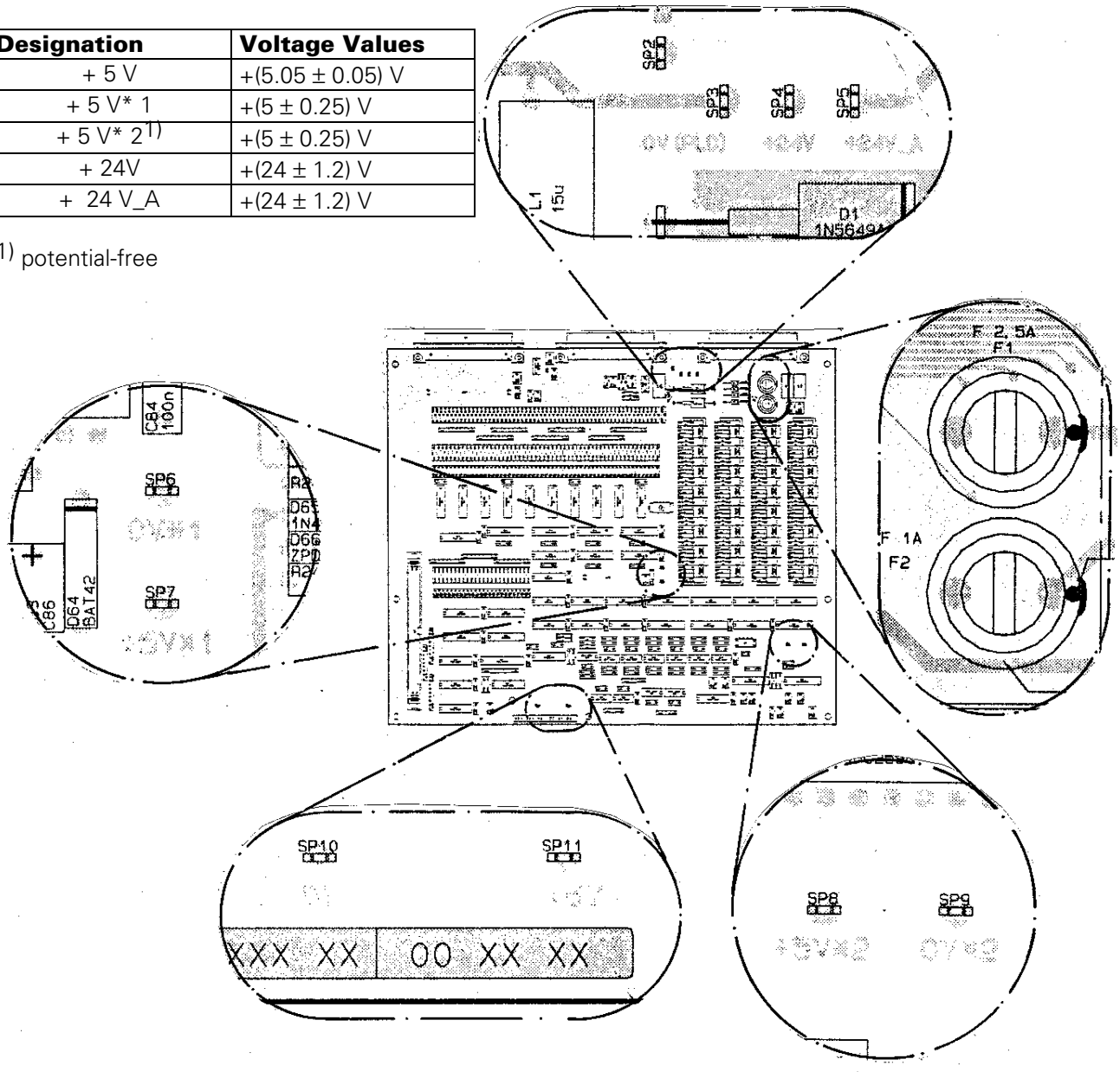
The power supply line for the PLC I/O board PL 400 is connected to the terminal blocks X12 (0V) X13 (+24V_A can be switched off) and the terminal strip X3/pin 12 (+ 24V cannot be switched off), (see PLC connection diagram, section 8.5.2).

There is no fuse on the PLC I/O board (electronic power limiter).

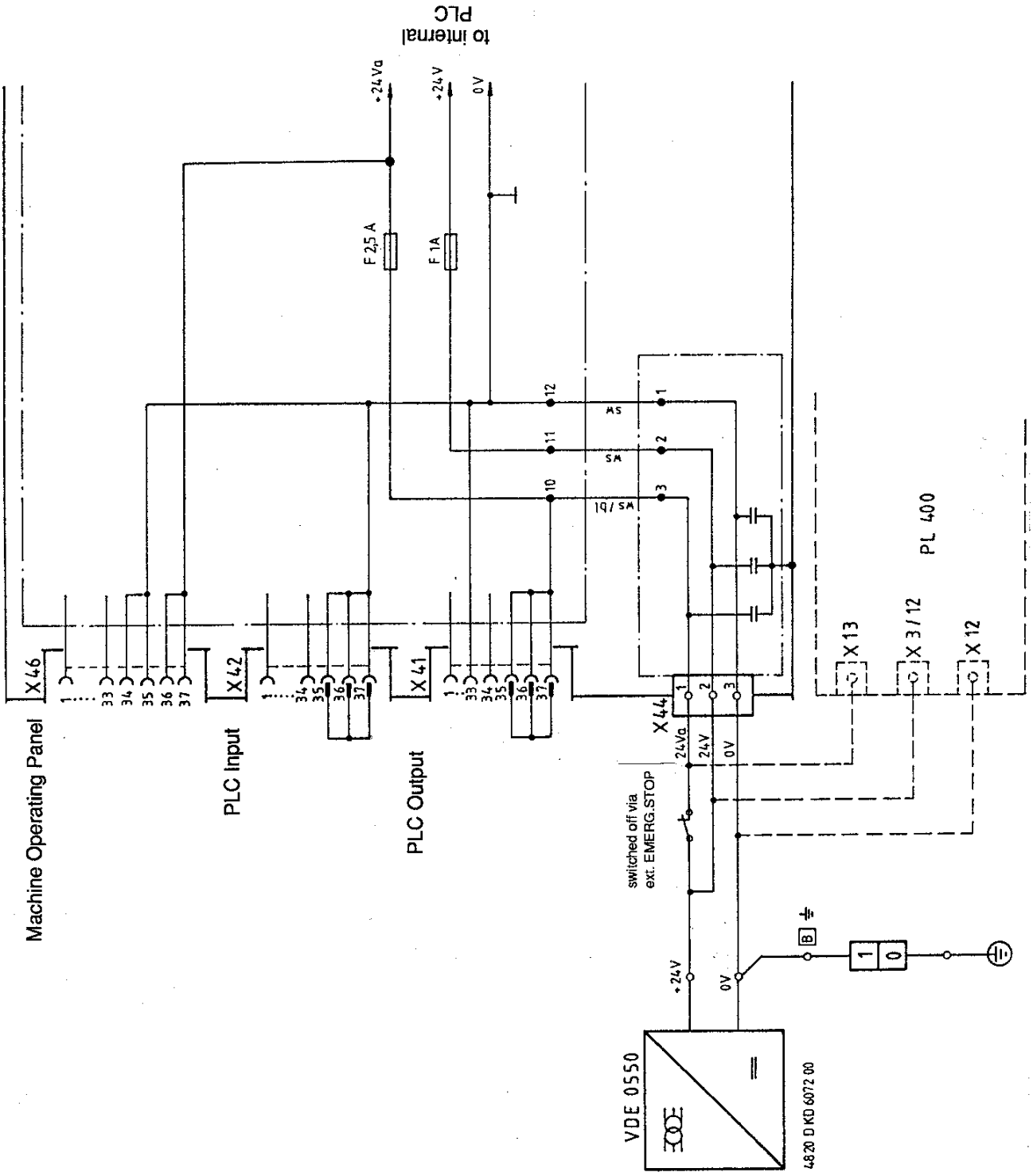
8.5.1 Voltage Measuring Points on the PLC Board

Designation	Voltage Values
+ 5 V	+(5.05 ± 0.05) V
+ 5 V* 1	+(5 ± 0.25) V
+ 5 V* 2[1)]	+(5 ± 0.25) V
+ 24V	+(24 ± 1.2) V
+ 24 V_A	+(24 ± 1.2) V

1) potential-free



8.5.2 Connection Schematic of the PLC Power Supply



8.6 Buffer Battery

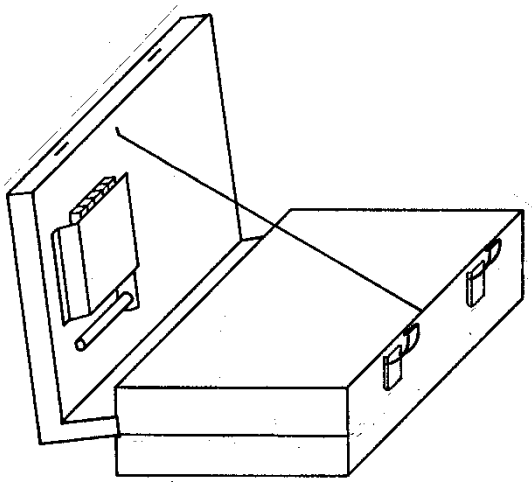
The buffer battery is the voltage source for the program memory if the machine is switched off.

If the error message

EXCHANGE BUFFER BATTERY

appears, the batteries must be exchanged within one week.

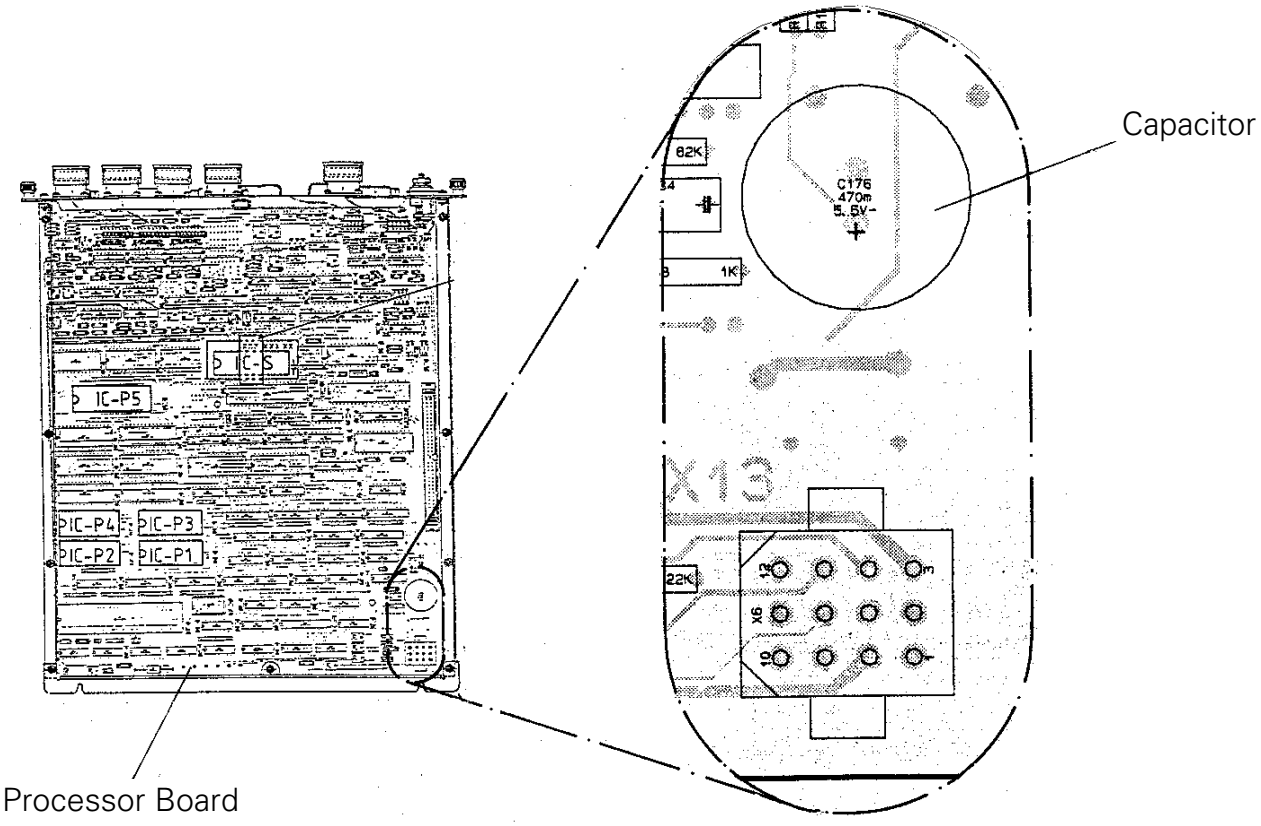
The buffer batteries are located behind a screw fitting in the power supply of the LE 360. To exchange open the LE by undoing both snaps.



3 AA-size batteries,
leak-proof,
IEC designation "LR6"

In order to protect the program memory of the TNC 306/360, a capacitor (located on the processor board) is used in addition to the batteries. Thus, the line voltage may be switched off during battery exchange.
Without batteries the capacitor is capable of maintaining the memory contents for about one day.

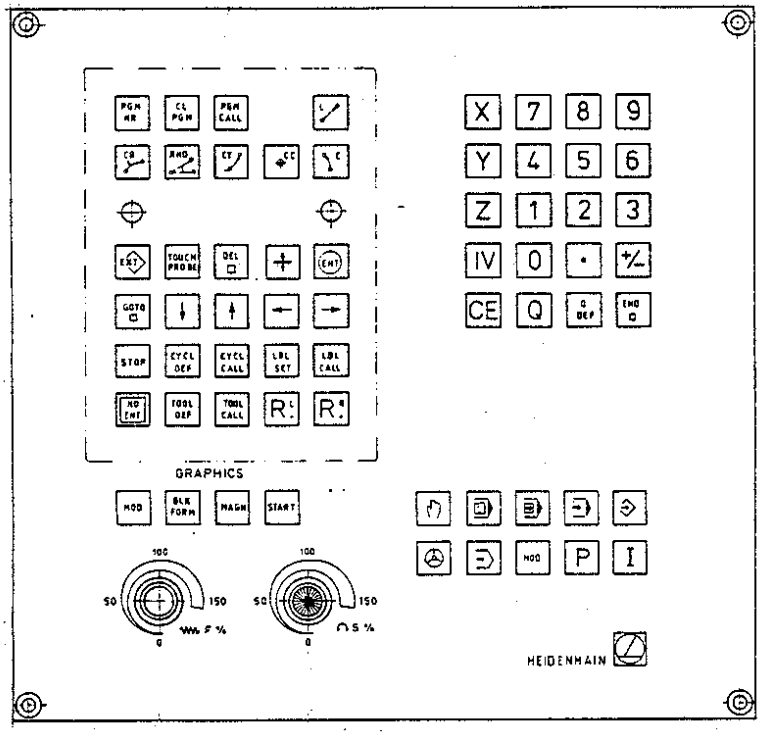
Only when the TNC is switched on is the capacitor being charged!



9. Keyboard Unit TE 355 A/B

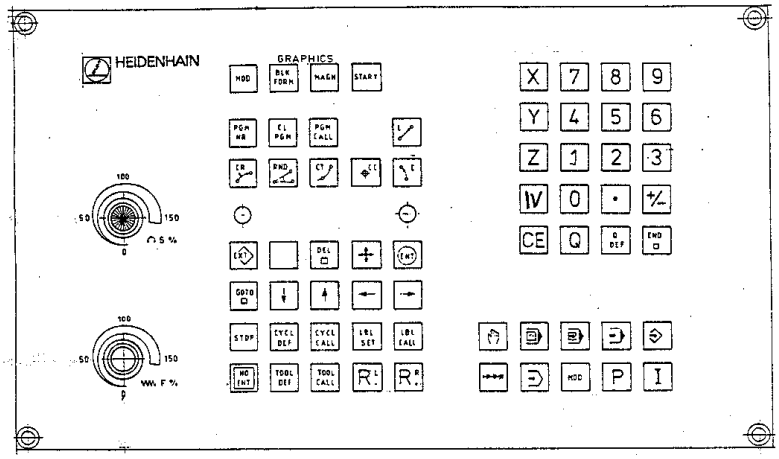
9.1 Overview

TE 355 A



tall version

TE 355 B



wide version

9.2 Checking the Keyboad Unit

The keyboard unit can be checked quickly and reliably by means of a measuring adaptor.

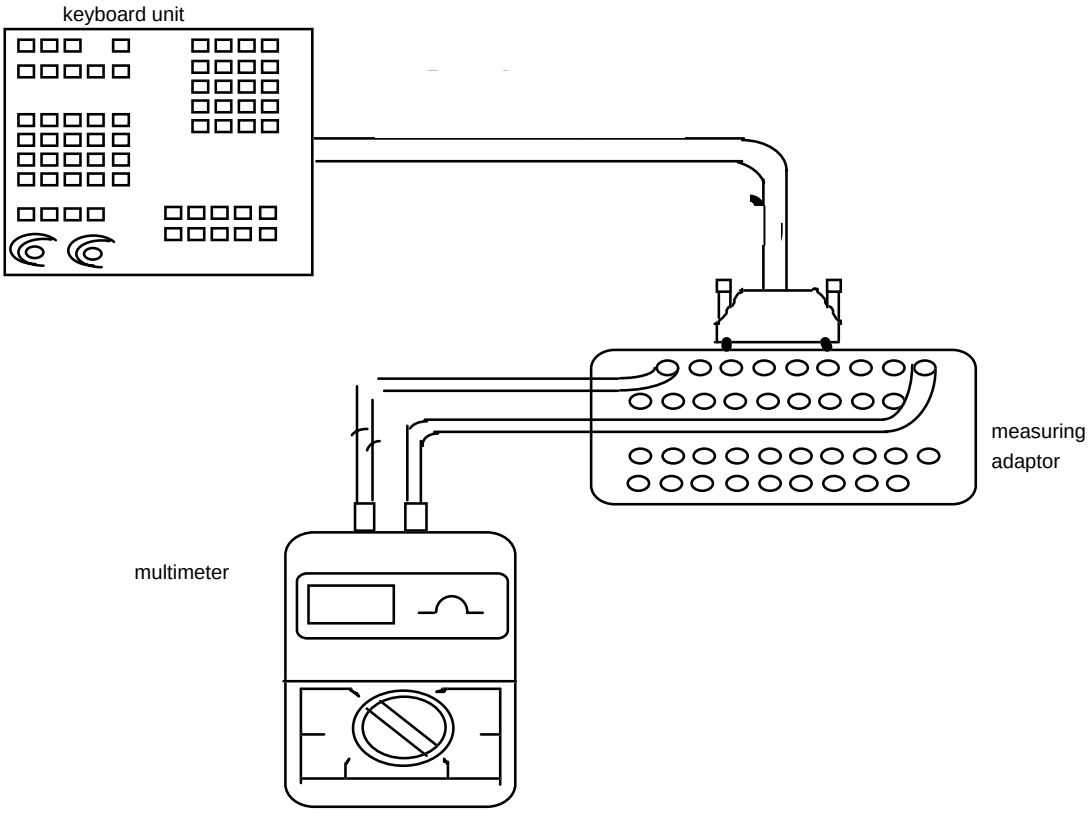
9.2.1 Checking the Key Functions

Procedure:

Disconnect the keyboard unit from the LE and connect the measuring adaptor (see sec. 18.4) to the keyboard unit.
Now, the key contacts can be measured at the measuring adaptor with an ohmmeter.

If e.g. the key PGM NR of the TNC operating panel is pressed, approx. 1Ω must be measured between PIN 8 and PIN 24 (see key matrix, sec. 9.2.5) of the measuring adaptor. (When performing this test, take into account the resistance of the measuring leads.)

9.2.2 Measurement Setup: Checking the Key Functions



Attention!
Always switch off the main switch before engaging or disengaging any connectors.

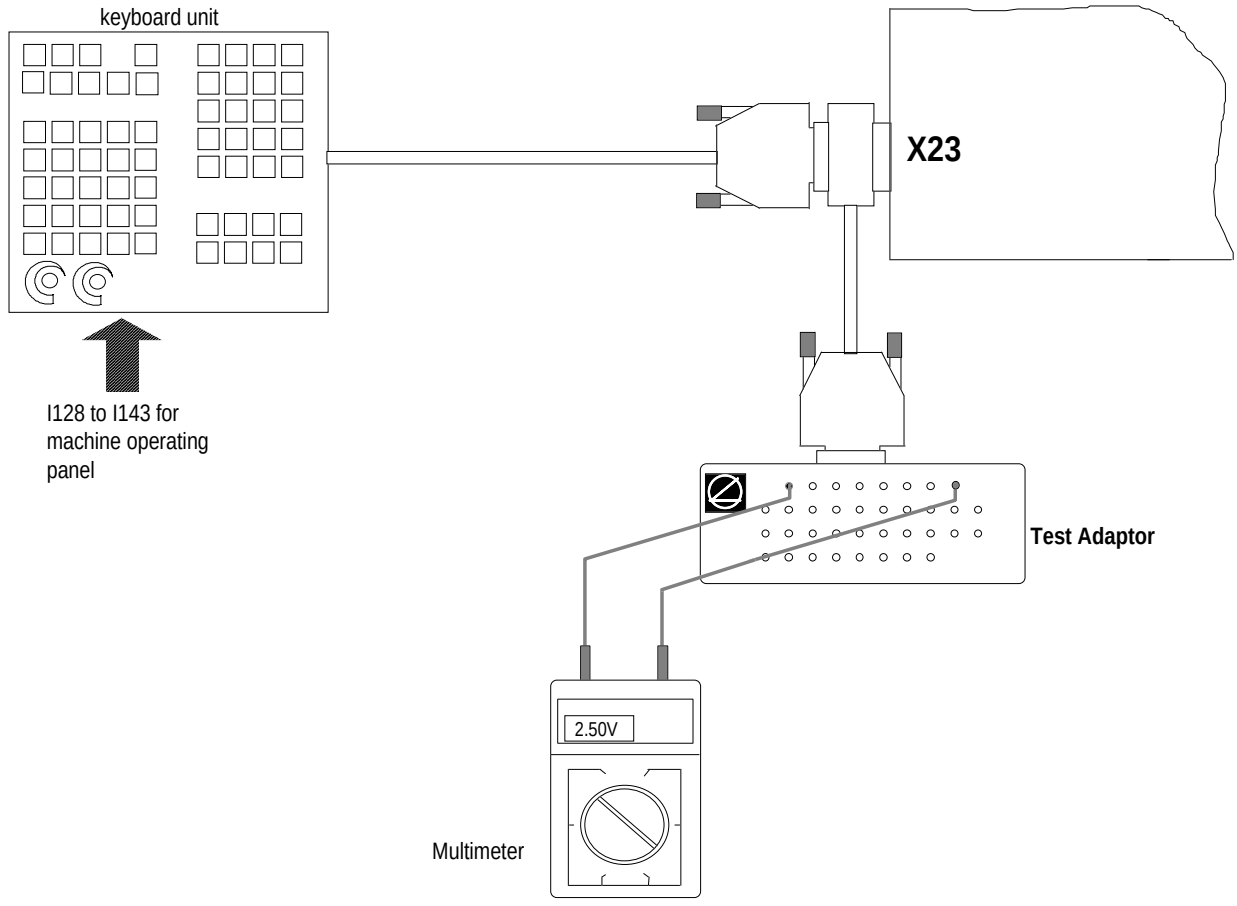
9.2.3 Checking the Potentiometers

Procedure:

Connect the measuring adaptor to connector X23 of the LE. Now the wiper voltages of the potentiometers can be measured with a multimeter.

Potentiometer	PIN	Voltage Range
Override F%	37 = 0V / 35 = + pot.	(0 ... approx. 4.95)V
Spindle S%	37 = 0V / 34 = + pot.	(0 ... approx. 4.95)V

9.2.4 Measuring Setup: Checking the Potentiometers



Attention!
Always switch off the main switch before engaging or disengaging any connectors.

9.2.5 Key Matrix

X2 Pin	1	2	3	4	5	6	7	8	20	21	22	23	24	25	26	27
key	RL0	RL1	RL2	RL3	RL4	RL5	RL6	RL7	SL0	SL1	SL2	SL3	SL4	SL5	SL6	SL7
PGM NR								⊕					⊕			
CL PGM							⊕						⊕			
PGM CALL						⊕							⊕			
CR																
L								⊕				⊕				
RND							⊕				⊕					
CT								⊕			⊕					
CC						⊕						⊕				
C					⊕							⊕				
MOD							⊕								⊕	
BLK FORM							⊕									⊕
MAGN								⊕								⊕
START						⊕										⊕

X2 pin	1	2	3	4	5	6	7	8	20	21	22	23	24	25	26	27
key	RL0	RL1	RL2	RL3	RL4	RL5	RL6	RL7	SL0	SL1	SL2	SL3	SL4	SL5	SL6	SL7
EXT					⊕								⊕			
TOUCH PROBE				⊕					⊕							
DEL □				⊕										⊕		
✣			⊕											⊕		
ENT	⊕													⊕		
GOTO □							⊕							⊕		
↓						⊕									⊕	
↑								⊕						⊕		
←						⊕								⊕		
→								⊕							⊕	
STOP					⊕						⊕					
CYCL DEF								⊕		⊕						
CYCL CALL							⊕			⊕						
LBL SET						⊕				⊕						
LBL CALL					⊕					⊕						
NO ENT		⊕												⊕		
TOOL DEF								⊕	⊕							
TOOL CALL							⊕		⊕							
R^L_-						⊕			⊕							
R^R_+					⊕				⊕							

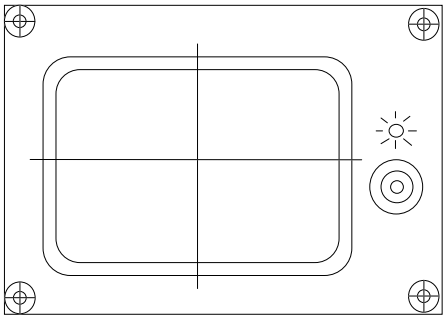
X2 pin	1	2	3	4	5	6	7	8	20	21	22	23	24	25	26	27
key	RL0	RL1	RL2	RL3	RL4	RL5	RL6	RL7	SL0	SL1	SL2	SL3	SL4	SL5	SL6	SL7
X				⊕									⊕			
7			⊕										⊕			
8		⊕											⊕			
9	⊕												⊕			
Y				⊕								⊕				
4			⊕									⊕				
5		⊕										⊕				
6	⊕											⊕				
Z				⊕							⊕					
1			⊕								⊕					
2		⊕									⊕					
3	⊕										⊕					
IV				⊕						⊕						
0		⊕								⊕						
.			⊕							⊕						
-/+	⊕									⊕						
CE					⊕									⊕		
Q			⊕						⊕							
Q DEF		⊕							⊕							
END	⊕								⊕							

X2 Pin	1	2	3	4	5	6	7	8	20	21	22	23	24	25	26	27
key	RL0	RL1	RL2	RL3	RL4	RL5	RL6	RL7	SL0	SL1	SL2	SL3	SL4	SL5	SL6	SL7
	⊕														⊕	
		⊕													⊕	
			⊕												⊕	
				⊕											⊕	
					⊕										⊕	
	⊕															⊕
		⊕														⊕
			⊕													⊕
				⊕												⊕
					⊕											⊕

10. Visual Display Units for TNC 306/360

10.1 Visual Display Unit BE 212

Id.No. 242 370 --



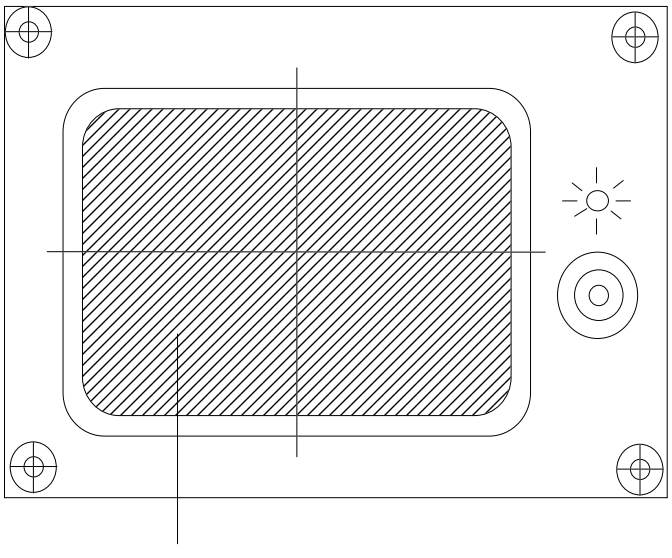
10.1.1 Checking the Visual Display Unit BE 212

If the screen remains dark when the machine is switched on, first check the power supply of the VDU.

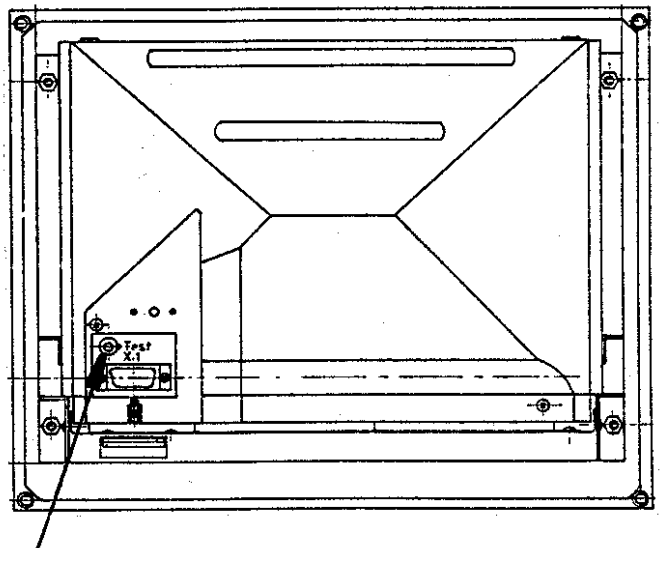
Procedure:
Connect the measuring adaptor between the VDU and the connector X2 of the LE. Now the voltage supply can be measured with a multmeter.

Pin No.	Signal
1, 8	0V supply
4	+ 12V supply

If the voltage supply is functioning properly, a square highlighted field can be generated on the screen of the VDU (which must be switched on) by pressing the external test button on the back side of the unit.



highlighted field



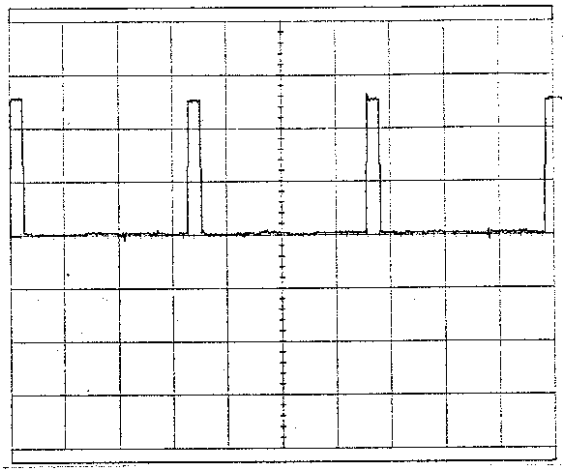
external test button

If the VDU remains dark after the test button was pressed, the VDU is defective and must be exchanged.
If however, the highlighted field appears, the processor board of the LOGIC UNIT is probably defective.
In addition, the control signals for the VISUAL DISPLAY UNIT can be checked with an oscilloscope.

Procedure:

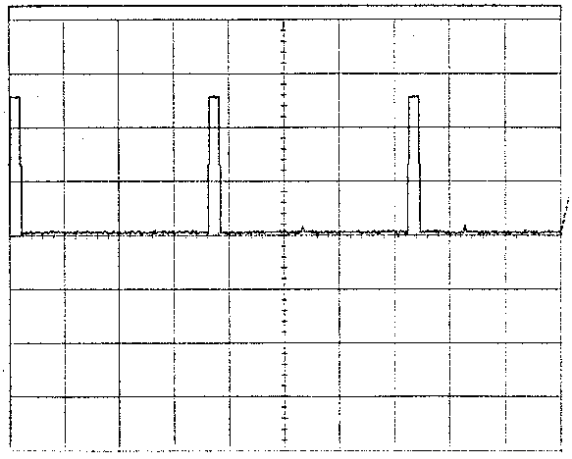
Connect the measuring adaptor between the VDU and connector X9 of the LE.
Measure the signals at the corresponding pins and compare the results to the following diagrams.

2V/DIV H-SYNC PIN 10



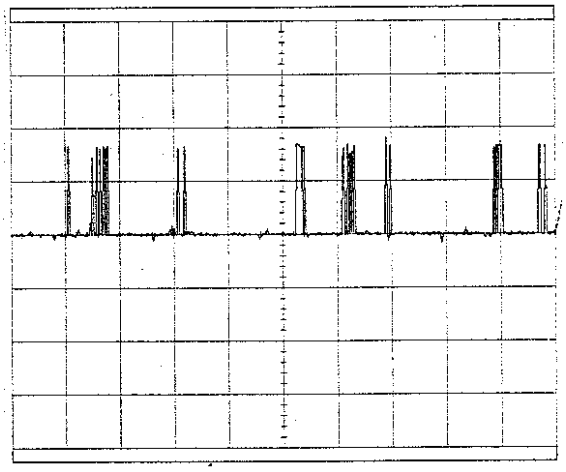
20 µs/DIV

2V/DIV V-SYNC PIN 9



5 ms/DIV

2V/DIV VIDEO PIN 13



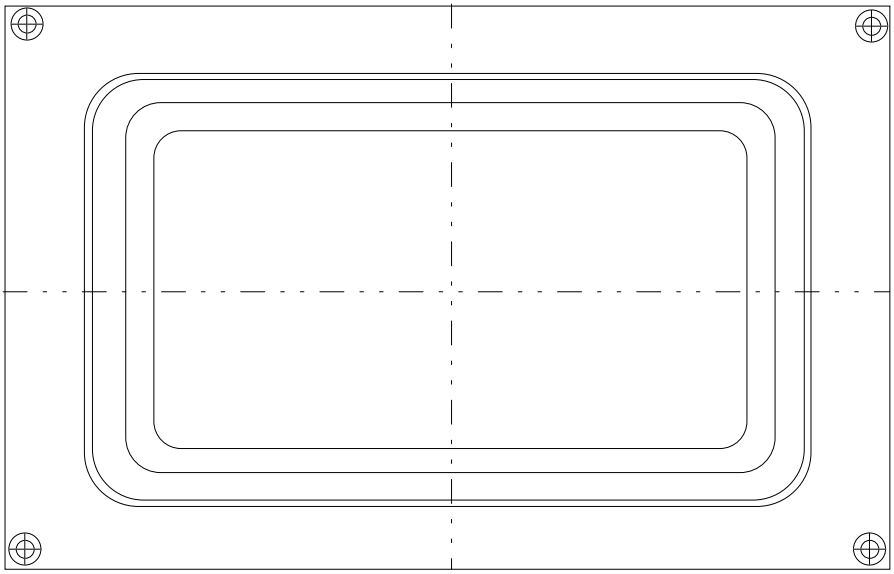
5 ms/DIV

Note:

With the VIDEO diagram (pin 13) a deviation in the time axis can occur, depending on the image being displayed.
Moreover, the amplitude (video) doubles, if:
- the VDU is disconnected
  or
- the external test button is pressed.

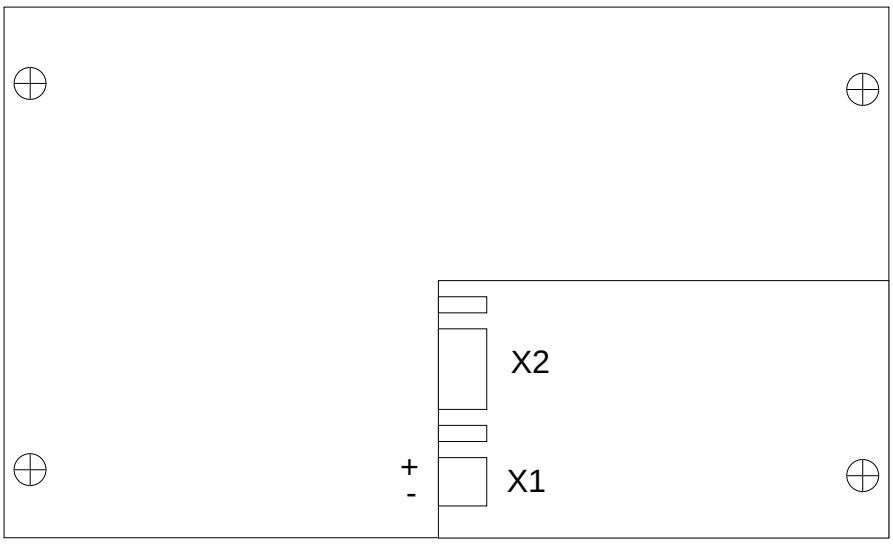
10.2 Flat Luminescent Screen BF 110

Id.No. 267 209 --



10.2.1 Checking the BF 110

If the screen remains dark when the TNC is switched on, the external voltage supply (see also sec.8.1) must be checked at the 2-pole terminal block. If the voltage supply is correct, disconnect the connecting cable TNC ↔ BF from the BF. Now check with an oscilloscope whether there are signals at the corresponding signal lines. If one or more signals are missing **entirely**, disconnect the connecting cable from the TNC as well and check whether the signal lines are interruped or short-circuited. If the connecting cable is in order, the PLC board is probably defective.
However, if there are signals at the signal lines, it is not possible to locate the malfunction (BF or PLC board) without special testing equipment.



11. Encoders

11.1 Error Messages

ENCODER <Axis> DEFECTIVE X

X = A Signal amplitude too low
B Frequency exceeded
C Wrong reference mark spacing

11.2 Error Causes

- Glass scale contaminated or damaged
- Scanning head contaminated or defective
- Cable damaged
- Encoder input of the LOGIC UNIT (LE) defective

11.3 Checking the Encoders

In order to determine whether the encoder or the encoder input of the LOGIC UNIT is defective, the encoders can be switched at the LOGIC UNIT. For this purpose, the corresponding machine parameters must be altered as well.

Function		**MP**	**Input Values**
Allocation of the axes	X	110.0	0 = X1
to the encoder inputs	Y	110.1	1 = X2
	Z	110.2	2 = X3
	IV	110.3	3 = X4
			4 = without function
			5 = X6[1)]

1) X6 can be used for a machine tool axis, if no spindle orientation is required.

Procedure if an error message is displayed:

e.g.: ENCODER X DEFECTIVE B

- Switch off main switch.
- Switch encoder X-axis with e.g. encoder Y-axis at the logic unit.
- Switch on main switch.
- If the error message "POWER INTERRUPTED" is generated, call the machine parameters with the code number 95148 and switch the input values of the machine parameters 110.0 and 110.1.
- Exit the machine parameters and switch on the machine as usual. If the same error message "ENCODER X DEFECTIVE B" is generated again, the error is due to the encoder or to the extension cable.If the errror message now says "Y" instead of "X" the encoder input of the LOGIC UNIT is defective.

11.3.1 Electrical Check of Encoders

In order to give a precise statement on the electrical function of an encoder, it must be measured with a phase angle measuring unit (PWM), an oscilloscope and an impedance tester. (see operating instructions Encoder Diagnostic Kit)

If no phase angle measuring unit is available, the electrical state of the cable, the lamp and the photocells of an encoder can be checked with an ohmmeter:

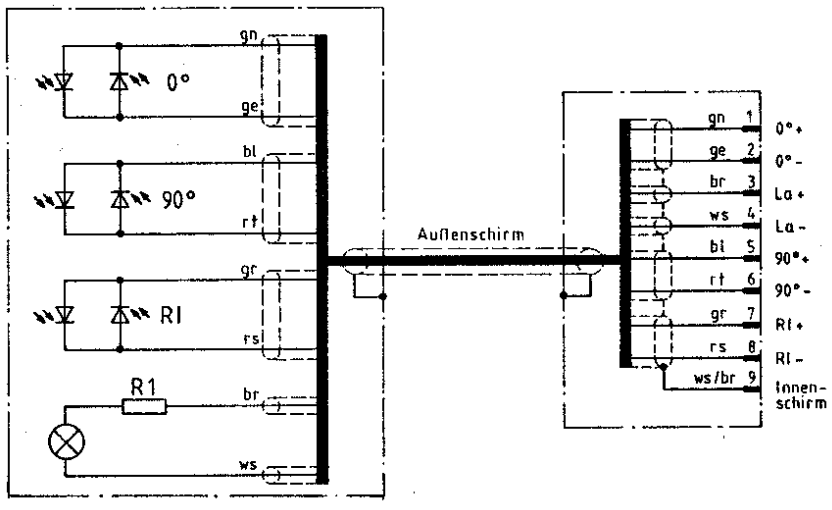
Measure resistanfce of:
- Encoder connector housing against machine housing (external shield) should be < 1 Ω
- Encoder connector housing against PIN 9 (internal shield - external shield) R = ∞
- Encoder connector housing against PIN 1 to 8 (external shield - signal lines) R = ∞
- Pin 9 against Pin 1 to 8 (internal shield- signal line) R = ∞

- Pin 1 against pin 2 0°
- Pin 2 against pin 1 0° (switch poles of ohmmeter)
- Pin 5 against pin 6 90° The measured values should
- Pin 6 against pin 5 90° (switch poles of ohmmeter) be approximately equal.
- Pin 7 against pin 8 RP[1)]
- Pin 8 against pin 7 RP[1)] (switch poles of ohmmeter)

- Pin 3 against pin 4[2)] (approx. 5 - 30 Ω)

1) If encoders with selectable reference marks are used, different resistance values are measured (or no resistance), depending on the type of activation.
2) The encoder check (PIN 3 against PIN 4) can only be carried out, if the encoder light unit is a lamp.
With encoders with an amplifier section, the light unit cannot be checked at all.
With encoders with infrared diodes, a resistance in the conducting direction can be measured between PIN 3 (+) and PIN 4 (-).

Basic Circuit Diagram with Sinusoidal Signal



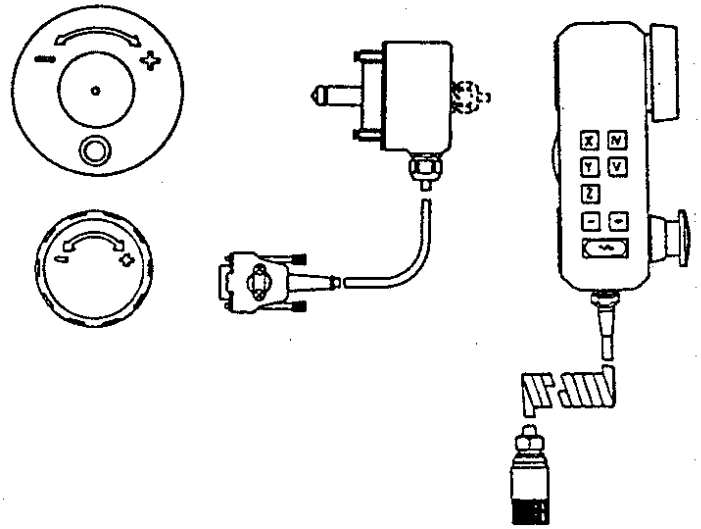
Encoders with square-wave output signals can only be tested with a phase angle measuring unit (PWM).

12. Handwheel HR 130/330

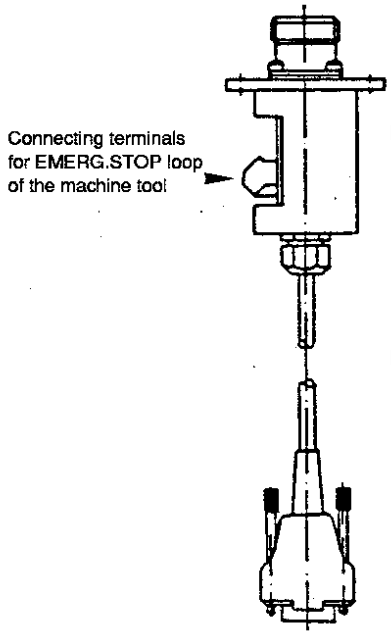
12.1 Overview

HR 130 Id.No. 254 040 –
HR 130.001 Id.No. 249 371 –

HR 330
Id.No. 251 534 –



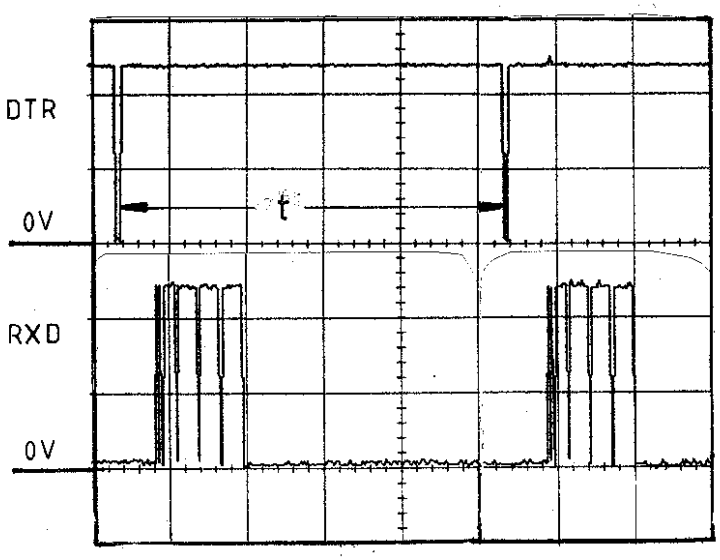
Cable adaptor for HR 330
Id.No. 249 889 –



Pin	Color	Signal
1	bl	EM.
2	bl	STOP
3	gn	RxD
4	ye	DTR
5	br	+12V
6	wh	0V

Pin	Color	Signal
1	wh	0V
4	br	+12V
6	ye	DTR
8	gn	RxD

12.2 Checking the Handwheel HR 130/330



The serial handwheels HR 130 and HR 330 can only be tested with an oscilloscope. The control signals (X11 PIN6 = DTR, PIN8 = RxD) must correspond to the diagram at the left. The supply voltage for the handwheel is fed via the logic unit (X11, PIN2 = 0V, PIN4 = + 12V).

t = 6 ms

12.3 Error Messages

HANDWHEEL?

The data transfer (cable) has been interrupted.

HANDWHEEL DEFECTIVE

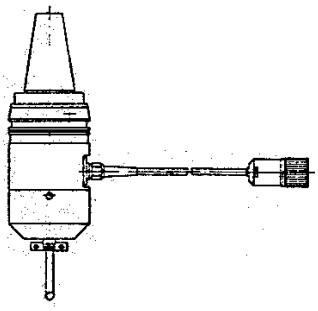
The light unit in the electronic handwheel is not emitting enough light, with the result that the signals in the handwheel are too small. An error signal is sent over the serial interface of the handwheel.

13. 3D-Touch Probe Systems

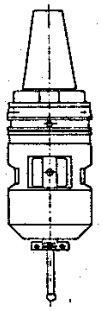
13.1 Overview

13.1.1 Touch Probe Systems with External APE

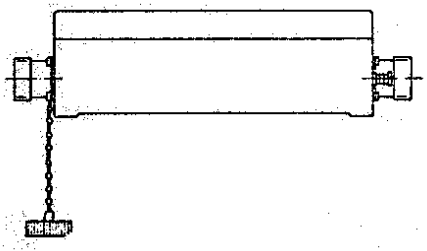
TS 111 Id.No. 237 400 --
with transmission cable



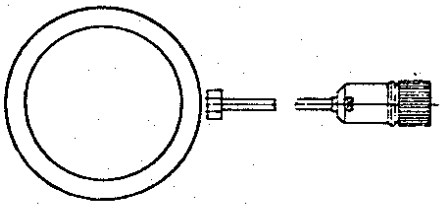
TS 511 Id.No. 237 402 --
with infrared signal transmission



APE 110 Id.No. 230 465 -- for **TS 111**
APE 510 Id.No. 227 590 -- for **TS 511**
APE 511 Id.No. 237 586 -- for **TS 511**
and with additional connection
for a second **SE 510**

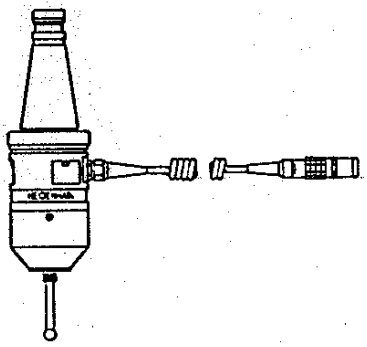


SE 510 Id.No. 230 473 --

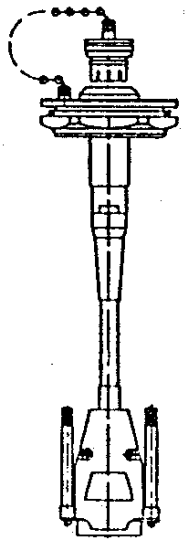


13.1.2 Touch Probe System with Integrated APE

TS 120 Id.No. 243 614 --



Adaptor Cable for TS 120 Id.No. 244 891 --



13.2 Error Messages

13.2.1 Error Messages during Probing

TOUCH POINT INACCESSIBLE

- After the start of a probing function, the scanning point was not reached within the measuring range defined in the machine parameter 6130.

EXCHANGE TOUCH PROBE BATTERY

- The battery voltage of the touch probe system with infrared transmission is below the minimum permissible value.

STYLUS ALREADY IN CONTACT

- The stylus was already deflected when the probing function was started.

PROBE SYSTEM NOT READY

- The infrared transmission between "Encoder" and "Transmitter/Receiver Unit" is faulty (e.g. caused by contamination) or interrupted. The two windows of the touch probe must be oriented to the transmitter/receiver unit.
- The battery is dead.

13.2.2 Error Messages during Digitizing of 3D-Contours

WRONG AXIS PROGRAMMED

- The touch probe axis in the scanning cycle **RANGE** is not identical to the calibrated touch probe axis.

FAULTY RANGE DATA

- In the scanning cycle **RANGE** a MIN coordinate value is higher than or equal to the corresponding MAX coordinate value.
- One or more coordinates are beyond the range determined by the software limit switches in the scanning cycle **RANGE**.
- No scanning cycle **RANGE** is defined when calling the scanning cycles **MEANDER** or **CONTOUR LINES**.

MIRRORING NOT PERMITTED

ROTATION NOT PERMITTED

SCALING FACTOR NOT PERMITTED

- Mirroring, rotation or scaling factor were active when the scanning cycles **RANGE, MEANDER** or **CONTOUR LINES** were called.

RANGE EXCEEDED

- The range has been exceeded during scanning, i.e. a part of the contour is outside the range.

CYCL-PARAMETER INCORRECT

- The programmed travel or the distance between lines or points is negative or > 56 535 mm (only possible with Q-parameter programming).

TOUCH POINT INACCESSIBLE

- The stylus was deflected before the range was reached during approach.
- In the cycle **CONTOUR LINES,** the stylus was not deflected within the range.

STYLUS ALREADY IN CONTACT

- The stylus is not at rest, although it is not touching the contour.

PLANE WRONGLY DEFINED

- One of the coordinates of the starting point in the cycle **CONTOUR LINES** is identical to the touch probe axis.

START POSITION INCORRECT

- The coordinate of the starting point that is identical to the starting probe axis, is beyond the defined range.

AXIS DOUBLE PROGRAMMED

- The same axis has been programmed for both starting point coordinates in the cycle **CONTOUR LINES**.

TIME LIMIT EXCEEDED

- In the scanning cycle **CONTOUR LINES** the first point of the scanned line was not reached within the programmed time limit.

14. RS-232-C-/V.24 Data Interface

14.1 Operating Modes ME FE EXT

For data transfer the TNC 306/360 can be switched to the following 3 operating modes:

ME — For connection of the HEIDENHAIN Magnetic Tape Unit ME 101/102 or other peripheral units. Data format **adapted** to the ME: 7 data bits, 1 stop bit, even parity, Baud rate 2400.

FE — For connection of the HEIDENHAIN Floppy Disk Unit FE 401/401B or other peripheral units. Data are transferred with a special protocol (blockwise transfer) for data security. Data format **adapated** to the FE: 7 data bits, 1 stop bit, even parity, Baud rate 9600 and transfer protocol.

EXT — To adapt the transfer of data to external peripheral units in standard data format and for blockwise transfer. The interface for data transfer is adapted via machine parameters; **any** Baud rate **may be selected**.
Peripheral units for the EXT operating mode are:
- punched tapes and punched-tape readers
- mass storage media or programming stations for "Blockwise Transfer"
- programming stations and personal computers for external programming

The Baud rate set at the TNC must always match that of the peripheral unit.
Possible Baud rates: 110 - 38 400

14.2 Interface Configuration

14.2.1 Allocation of the Operating Modes

Press key	Function
MOD	activate auxiliary mode "MOD"
↓ or ↑	press key repeatedly until the dialog RS232-INTERFACE = XXX is displayed
ENT	press key repeatedly until the desired operating mode is displayed
END	exit auxiliary mode "MOD"

14.2.2 Selecting the Baud Rate

press key	function
MOD	activate auxiliary mode "MOD"
↓ or ↑	press key repeatedly until the dialog BAUD-RATE = XXXXX is displayed
	enter desired Baud rate [1]
...	transfer entered value
END	exit auxiliary mode "MOD"

1) Possible entry values: 110, 150, 300, 600, 1200, 2400, 4600, 9600, 19200, 38400 Baud

If an incorrect value is entered, the error message

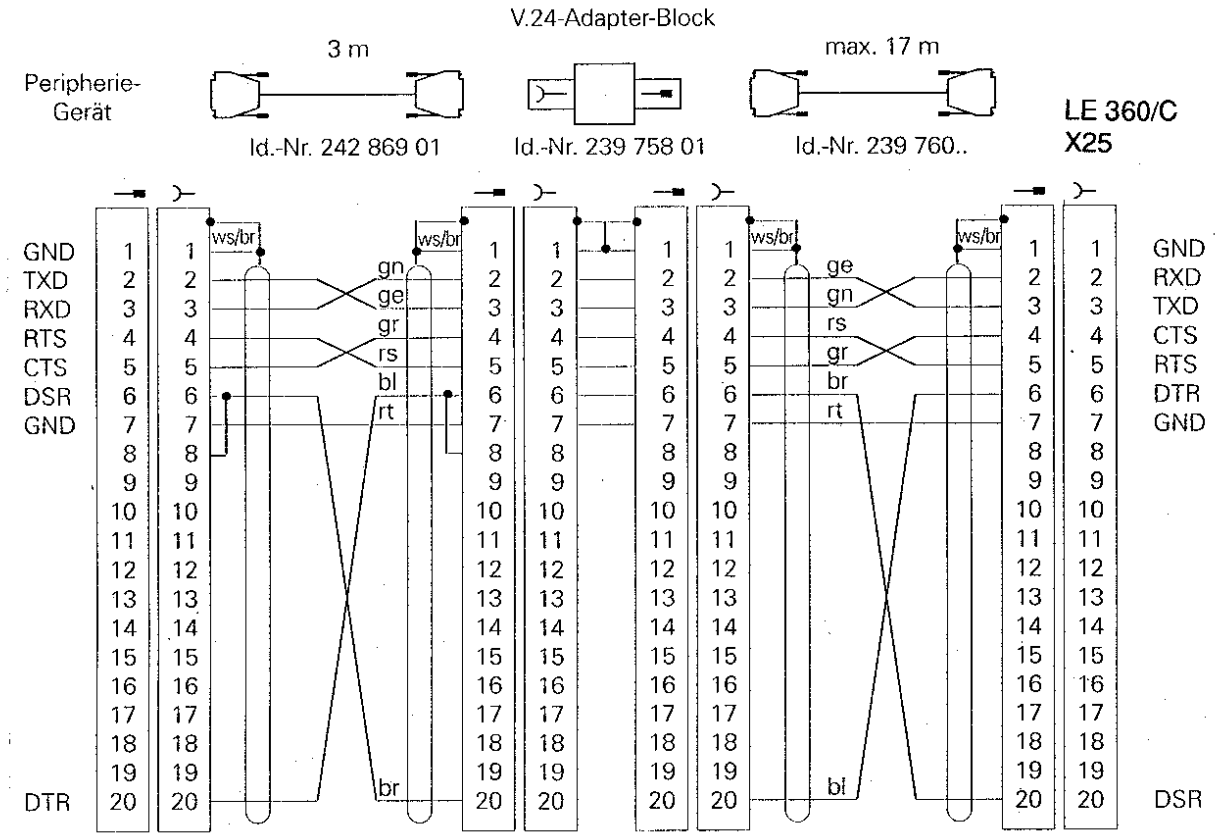
ENTRY VALUE INCORRECT

is displayed.

Note:
Only in the EXT operating mode is it possible to select any Baud rate. In the operating modes ME and FE, the Baud rates of 2400 and 9600 Baud are preset by the TNC.

14.3 Connecting Cables and Adaptors for the RS-232-C/V.24 Data Interface

14.3.1 Wiring Diagram of the RS-232-C-/V.24-Data Interface



In general, simplified wiring of the data transfer cable is sufficient for transfer via the RS232-C interface with DC1/DC3 protocol.
GND chassis
RxD signal line
TxD signal line
GND signal ground
Bridge CTS/RTS
Bridge DTR/DSR

The data lines and the control lines of the cable between the LE 360/C and the RS-232 adaptor block (Id.No. 239 760 ..) are transposed. The pin assignment of the connector X25 of the LE 360/C corresponds to a that of a data circuit terminating equipment (DCE). Due to the transposed data and control lines of the cable between LE 360/C and RS-232 adaptor, the assignment at the RS-232 adaptor corresponds to a data terminal equipment (DTE) Thus, the external units may be connected to the RS-232 adaptor via the standard HEIDENHAIN data transfer cable (Id.No. 242 869 01).

The RS-232-C-/V.24 data interface has different pin assignments at the logic unit X25 and at the RS-232 adaptor block.
If the pin layout of your peripheral unit is different from the above, the HEIDENHAIN connecting cable cannot be used.

14.4 Machine Parameters for the RS-232-C-/ V.24-Interface

The detailed functions of the machine parameters are explained in the TNC-Manual for Machine Tool Manufacturers and in the information on the data interface RS-232-C-/V.24

In the operating modes **ME** and **FE** the interface parameters are fixed. In the **EXT** operating mode, the machine parameter values for the data interface that are preset by the control can be altered.

14.4.1 Machine Parameters for "Standard Interface" (e.g. for ME 101, Printer)

MP	Function	Entry Values
5010.0	Control character for end of program	3 = ETX
5020	7 data bits, transfer stop by DC 3 parity bit (even parity), 1 stop bit	168
5030	Standard data interface	0

14.4.2 Machine Parameters for "Transfer Blockwise"

MP	Bit	Function	Entry Values
5010.0	0...7	ETX or any ASCII character. Character for end of program	ETX and STX: 515
	8...15	STX or any ASCII character. Character for program start	
5010.1	0...7	H or any ASCII character. Is transferred in the command block for data input before the program number.	H and E: 17736
	8...15	E or any ASCII character. Is transferred in the command block for data input after the program number.	
5010.2	0...7	H or any ASCII character. Is transferred in the command block for data input before the program number.	H and A: 16712
	8...15	E or any ASCII character. Is transferred in the command block for data input after the program number.	
5010.3	0...7	ETB or substitute character. Is sent at the end of the command block.	ETB and SOH: 279
	8...15	SOH or substitute character. Is sent at the beginning of the command block.	
5010.4	0...7	ACK or substitute character for pos. acknowledgement. Is transferred, after the data block was received correctly.	ACK and NAK: 5382
	8...15	NAK or substitute character for neg. acknowledgement. Is transferred , if the data block was received defectively.	

MP	Function	Entry Value
5010.5	EOT or substitute character. Is transferred at the end of data transfer.	EOT: 4
5030	7 data bits, transfer stop by DC3, parity bit (even parity), 1 stop bit	168
5030	Transfer blockwise	1

Determination of the input value:

Example: Program end: ETX BINARY code 00000011 (low byte)
Program start: STX BINARY code 00000010 (high byte)

Bit 0 - 7 (low byte)	7	6	5	4	3	2	1	0
Significance	128	64	32	16	8	4	2	1
Enter 0 or 1	0	0	0	0	0	0	1	1

Bit 8 - 15 (high byte)	15	14	13	12	11	10	9	8
Significance	32 768	16 384	8 192	4 096	2 048	10 24	512	256
Enter 0 or 1	0	0	0	0	0	0	1	0

Determine input value:
```
    1
    2
+ 512
-------
  515
```

The input value for the machine parameter MP 5010.0 is 515.

14.5 Printer Connection

For most printers we recommend simplified wiring (see section 14.3).

14.6 Error Messages

14.6.1 Error Messages at the TNC in the FE-Mode

In this operating mode, the floppy disk unit outputs errors in the following format:

(SOH) ERR : (SP) (SP) (SP) XXX (ETB) (BCC)

The following errors can be displayed on the screen:

Input/output errors

ERR	001	Wrong command code
ERR	002	Illegal program name
ERR	003	Faulty data transfer
ERR	004	Program incomplete on disk
ERR	005	Overflow of receiving buffer
ERR	006	PRT interface selected more than once by the TNC
ERR	007	Data-buffer overflow

Errors during program write or read

ERR	010	Program not on disk
ERR	011	Program erase-protected
ERR	012	Program is being written to
ERR	013	Program directory is full
ERR	014	Disk is full
ERR	015	Text not found
ERR	016	Program name already exists
ERR	017	Disk access active
ERR	018	Program currently being read

Disk / drive / controller errors

ERR	100	Disk not initialized
ERR	101	Sector number too large [1]
ERR	102	Drive not ready [2]
ERR	103	Disk is write-protected
ERR	104	Faulty data on disk [1]
ERR	105	Sector cannot be found [1]
ERR	106	Check sum incorrect [1]
ERR	107	Disk controller defective [3]
ERR	108	DMA defective [3]
ERR	109	Disk exchanged during program loading

1) These error messages indicate that the disk is defective; in most cases, they can only be eliminated by reformatting the disk.
2) If this error message comes up while the disk is inserted, the drive is defective.
3) Hardware defect.

14.6.2 Error Messages during Data Transfer via the RS-232C Interface

TRANSFERRED VALUE ERRONEOUS X

X = A Faulty character frame
B Character overflow
C Faulty character frame or character overflow
D Parity error
E Faulty character frame or parity error
F Character overflow or parity error
G Faulty character frame or character overflow or parity error
H Overflow of receiveing buffer
M Control has received the character for "negative acknowledgement" (NAK) more than 3 times
N Control has sent the character for "negative acknowledgement" (NAK) more than 3 times

EXT. INPUT/OUTPUT NOT READY

- DSR signal missing at the TNC
- FE not connected
- Defective or wrong transfer cable

WRONG PROGRAM DATA

Wrong program data have been detected during data transfer.

ENTRY VALUE INCORRECT

- The control requires more machine parameters than are stored on the external data medium.
- One or more machine parameters on the external data medium have non-permissible values.

NOTES

15. External Data Transfer

15.1 External Data Input

Preparation:

- Connect the external data carrier (ME, FE or peripheral unit e.g. personal computer with HEIDENHAIN data transfer software) to the TNC.

- Prepare the external data medium for data transfer:

  press STOP at the FE

- Configure the interface (see section 14.2)

File Overview TNC 306/360

File	**File Extension on FE**	**File Extenion on PC with HEIDENHAIN Data Transfer Software**
PLC-Programs	XXX.P	XXX.PNC
Machine Parameters	XXX.M	XXX.MNC
NC-Programs	XXX.H	XXX.HNC
Central Tool File	0.H	0.HNC
Compensation Value List	XXX.S	XXX.SNC

Notes

15.1.1 Machine Parameter Input

OPERATION PARAMETERS ERASED

If this error message is displayed load the machine parameters as follows:

Press key	Function
CE	Clear **OPERATION PARAMETERS ERASED**
CE	Clear **PLC: PROGRAM MEMORY ERASED**
MOD	Configure the interface as described in section 14.2.
END EXT	Prepare TNC for data input
	Enter the program number under which the machine parameters are stored.
ENT	Start data transfer

When the data transfer is finished, the following dialog

EXTERNAL DATA INPUT [1] is cleared.

END	Exit the machine parameter mode.
CE	Clear **POWER INTERRUPTED**

[1] If the error message

ENTRY VALUE INCORRECT

is generated during data input, this can be due to the following reasons:

- The TNC requires more machine parameters than are stored on the external data medium (e.g. after a software exchange).

- At least one machine parameter has a non-permissible value.

- Press ENT to continue data transfer and enter the missing or incorrect parameter values manually after the transfer.
  Contact your machine tool manufacturer regarding these machine parameters.

Load the machine parameters as follows, if the memory has not been erased (the machine parameters in the RAM will be **overwritten**).

Press key	Function
MOD	Activate auxiliary mode "MOD"
↓ or ↑	Press key repeatedly until the dialog CODE NUMBER= is displayed
	Enter code number
ENT	Acitvate MP mode
EXT ENT	Prepare TNC for data input
...	
...	Enter the number of the program in which the machine parameters are stored
ENT	Start data transfer

When the data transfer is finished, the dialog

EXTERNAL DATA INPUT [1] is cleared.

END	Exit MP mode
CE	Clear the message **POWER INTERRUPTED** (only, if important machine parameters have been altered, e.g. MP 1390)

1) If the error message **ENTRY VALUE INCORRECT** is displayed during data transfer, this can be due to the following reasons:

- The TNC requires more machine parameters than are stored on the external data medium (e.g. after a software exchange).

- At least one machine parameter has a non-permissible value.

- Press ENT to continue data transfer and enter the missing/incorrect parameters manually after the transfer.
  Contact your machine tool manufacturer regarding these parameters.

15.1.2 Downloading the PLC Program

Press key	Function
MOD	Activate auxiliary mode "MOD"
↓ or ↑	Press key repeatedly until the dialog CODE NUMBER= is displayed
8 0 7 6 6 7	Enter code number
ENT	Activate MP mode
↓ or ↑	Select item UTILIZATION
ENT	Call program

Now, the memory location for the program to be transferred must be reserved in the RAM with TOTAL MEMORY: XX KBYTE.

	Key in value (max. value: 69) [1]
ENT	Confirm entry
END	Return to the PLC main menu
EXT	Prepare TNC for data input
↓ or ↑	Select item READ-IN SELECTED PROGRAM
ENT	Activate
	Enter the program number under which the PLC program has been stored
ENT	Start data transfer

When the data transfer is finished **EXTERAL DATA INPUT** is cleared and the TNC returns to the PLC main menu.

END	Exit the PLC mode

[1] If the memory location reserved in the RAM is smaller than the program to be transferred, data transfer is interrupted by the error message

PROGRAM MEMORY EXCEEDED XX

15.1.3 Calling Directory of all NC Programs (XXX.H) on External Data Medium

Press key	Function
→	Activate operating mode PROGRAMMING AND EDITING
EXT	Prepare TNC for data input
↓ or ↑	Select item PROGRAM DIRECTORY
ENT	Acitvate selection

All NC programs that are stored on the external data medium are now displayed.

NO ENT	Return to operating mode PROGRAMMING AND EDITING

15.1.4 Downloading all NC Programs

Press key	Function
→	Activate operating mode PROGRAMMING AND EDITING
EXT	Prepare TNC for data input
↓ or ↑	Select item READ-IN ALL PROGRAMS
ENT	Start data transfer

When the data transfer is finished, the dialog **EXTERNAL DATA INPUT** is cleared and the control is at the NC program downloaded last.

	Change operating mode

Note:
The tool data for the central tool file (MP7260 ≠ 0) are stored in the **NC program No. 0**.

15.1.5 Input of a Canned NC Program

Press key	Function
→	Activate operating mode PROGRAMMING AND EDITING
EXT	Prepare TNC for data input
↓ or ↑	Select item READ-IN PROGRAM OFFERED
ENT	Activate selection
ENT	Download program
NO ENT	Do not download program

When the data transfer is finished, the dialog **EXTERNAL DATA INPUT** is cleared and the control is at the NC program downloaded last.

	Change operating mode

15.1.6 Downloading a Selected NC Program

Press key	Function
→	Activate operating mode PROGRAMMING AND EDITING
EXT	Prepare TNC for data input
↓ or ↑	Select item READ-IN SELECTED PROGRAM
ENT	Activate selection
...	Enter the program number under which the NC program is stored
ENT	Start data transfer

When data transfer is finished, the dialog **EXTERNAL DATA INPUT** is cleared and the control is at the NC program downloaded last.

	Change operating mode

15.1.7 Downloading the Tool Table

Machine parameters for the central tool file:

Parameter No.	Entry values
7260	0 → no central tool file 1 ... 99 → central tool file entry value = maximum number of tools in the tool file

If MP 7260 > 0, the control automatically creates a tool table in the **NC-PGM 0,** according to the value entered in MP 7260. This table can be downloaded as follows:

Press key	Function
→	Activate operating mode PROGRAMMING AND EDITING
EXT	Prepare TNC for data input
↓ or ↑	Select item READ-IN SELECTED PROGRAM
ENT	Activate selection
0	Enter program number 0
ENT	Start data transfer
CE	Clear dialog PROGRAM NUMBER ALLOCATED (tool data in the control are overwritten)

When data transfer is finished, the dialog **EXTERNAL DATA INPUT** is cleared and the control is at the tool table.

	Change operating mode

Possible Error Messages

WRONG PROGRAM DATA 0/XX

- The current value in MP 7260 is not equal to the value it had when the tool table was read out.

ENTRY VALUE INCORRECT

- The entry value of MP 7260 is 0.

15.1.8 Downloading the Compensation Value List

Machine parameters for multipoint axis error compensation

Parameter No.	Entry value	Function
730	0 ... 15	mulitpoint axis error compensation
bit		
0	+ 0 → inactive + 1 → active	X-axis
1	+ 0 → inactive + 2 → active	Y-axis
2	+ 0 → inactive + 4 → active	Z-axis
3	+ 0 → inactive + 8 → active	IV-axis

Press key	Function
MOD	Activate auxiliary mode "MOD"
↓ or ↑	Press key repeatedly until the dialog CODE NUMBER = is displayed
1 0 5 2 9 6	Enter code number
ENT	Call submenu
↓ or ↑	Select item COMPENSATION VALUE LIST
ENT EXT ENT	Prepare TNC for data input
...	Enter the program number under which the compensation value list is stored

When the data transfer is finished, the dialog **EXTERNAL DATA INPUT** is cleared and the control is at the compensation value table of the X-axis.

END END	Exit compensation value list

15.2 External Data Output

15.2.1 Machine Parameter Output

Press key	Function
MOD	Activate auxiliary mode "MOD"
↓ or ↑	Press key repeatedly until the dialog CODE NUMBER= is displayed
9 5 1 4 8	Enter code number
ENT	Activate MP mode
EXT ENT	Prepare TNC for data output
...	Enter the program number under which the machine parameters are stored
ENT	Start data transfer

When the data transfer is finished, the dialog **EXTERNAL DATA OUTPUT** is cleared.

END	Exit MP mode

15.2.2 Output of the PLC Program

Press key	Function
MOD	Activate auxiliary mode "MOD"
↓ or ↑	press key repeatedly until the dialog CODE NUMBER= is displayed
8 0 7 6 6 7	Enter code number
ENT	Activate PLC mode
EXT	Prepare TNC for data output
↓ or ↑	Select desired output format
ENT	Acitvate selection
...	Enter program number under which the program is to be stored

When the data transfer is finished, the dialog **EXTERNAL DATA OUTPUT** is cleared.

END	Exit PLC mode

15.2.3 Output of a Selected NC Program

Press key	Function
→	Activate operating mode PROGRAMMING AND EDITING
EXT	Prepare TNC for data output
↓ or ↑	Select item OUTPUT SELECTED PROGRAM
ENT	Activate selection
↓ or ↑	select desired program
ENT	Output program
NO ENT	Do not output program
	Change operating mode

15.2.4 Output of All NC programs

Press Key	Function
→	Activate operating mode PROGRAMMING AND EDITING
ENT	Prepare TNC for data output
↓ or ↑	Select item OUTPUT ALL PROGRAMS
ENT	Start output of data

When data transfer is finished, the dialog **EXTERNAL DATA OUTPUT** is cleared and the NC program downloaded last is activated.

	Change operating mode

15.2.5 Output of a Tool Table

Machine parameters for the central tool memory

Parameter No.	Entry values
7260	0 → no central tool file 1 ... 99 → central tool file entry value = maximum number of tools in the tool file

If MP 7260 > 0, the control automatically creates a tool table in the **NC-PGM 0**, according to the value entered in MP 7260. The tool data this table contains can be output as follows:

Press key	Function
→	Activate operating mode PROGRAMMIN AND EDITING
EXT	Prepare TNC for data output
↓ or ↑	Select item OUTPUT SELECTED PROGRAM
ENT	Activate selection
↓ or ↑	Select program number 0
ENT	Start output of data

When data transfer is finished, the dialog **EXTERNAL DATA OUTPUT** is cleared.

NO ENT	Return to PROGRAMMING AND EDITING

15.2.6 Output of the Compensation Value List

Machine parameters for multipoint axis error compensation

Parameter No.	Entry value	Function
730	0 ... 15	multipoint axis error compensation
bit		
0	+ 0 → inactive + 1 → active	X-axis
1	+ 0 → inactive + 2 → active	Y-axis
2	+ 0 → inactive + 4 → active	Z-axis
3	+ 0 → inactive + 8 → active	IV-axis

Press key	Function
MOD	Activate auxiliary mode "MOD"
↓ or ↑	Press key repeatedly until the dialog CODE NUMBER= is displayed
1 0 5 2 9 6	Enter code number
ENT	Call submenu
↓ or ↑	Select item COMPENSATION VALUE LIST
ENT EXT NO ENT	Prepare TNC for data output
	Enter the program number under which the compensation value list is to be stored
ENT	Start data output

When the data transfer is finished, the dialog **EXTERNAL DATA OUTPUT** is cleared and the control enters the compensation value list for the X-axis.

END END	Exit the compensation value list

16. Analog Outputs

16.1 Specifications

5 outputs 1, 2, 3, 4 and S (TNC 360)
4 outputs 1, 2, 3, 4 (TNC 306)

Load capacity $R_{Lmin} \geq 5\ k\Omega$
$C_{Lmax} \leq 2\ nF$

Voltage range $U_{amax} = 10V \pm 100\ mV$
$U_{amin} = 0V \pm 3\ mV$

Machine parameters for the analog outputs

Axis	MP	
X	120.0	0 = output 1
Y	120.1	1 = output 2
Z	120.2	2 = output3
IV	120.3	3 = output 4
		(4 = output 5)
		5 = output S (only TNC 360)

Resolution	14 bits = 16 384 steps	
smallest step	$\frac{10\ V}{16384} = 0.610\ mV$	

16.2 Checking the Analog Output

Proportionally to the traversing speed, the control generates an analog voltage of 0V to 9V (depending on MP 1050.X). The easiest way to determine this voltage is to connect the TEST ADAPTOR directly to the LOGIC UNIT or to the connecting terminals of the servo-amplifier and to measure with a multimeter.

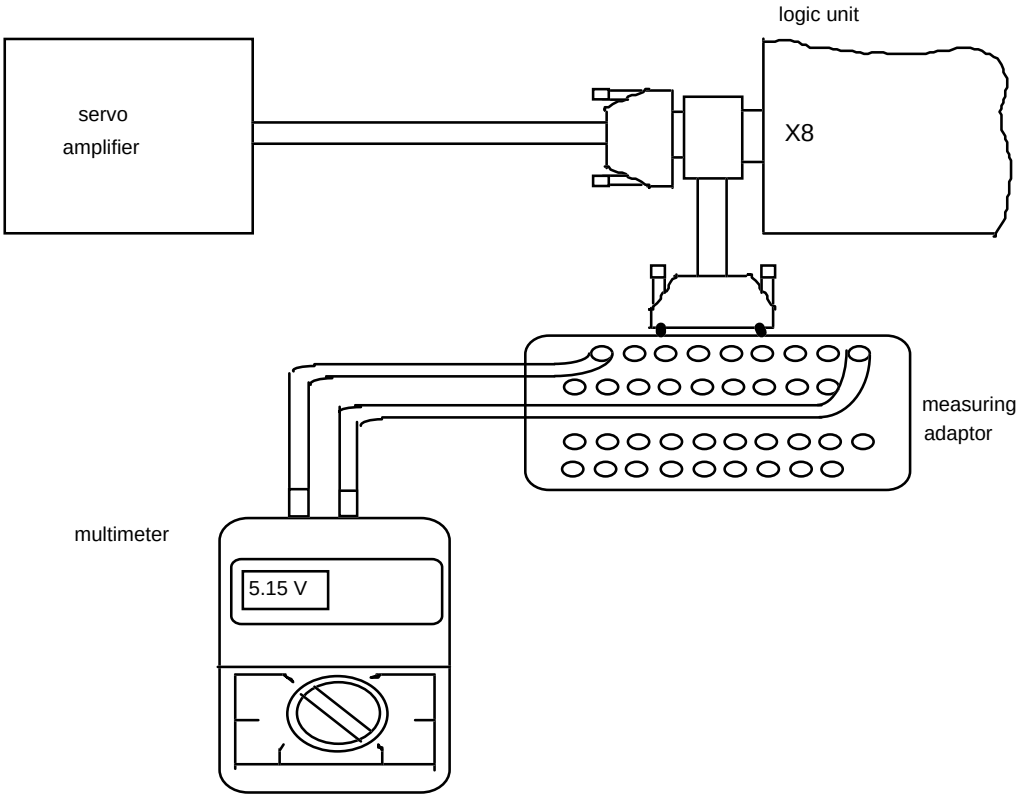
If however, the axis does not move due to a defect, and if you want to test whether the error is inside or outside the control, the following steps are recommended:
- Switch off main switch of the machine tool
- Connect the TEST ADAPTOR to the connector X8 (nominal value output) of the LE and connect a multimeter to the TEST ADAPTOR sockets for the defective axis.
  If no TEST ADAPTOR is available, connect a multimeter directly to the nominal value input of the servo-amplifier.
- Switch on the main switch and the control voltage.
- Switch the position display to "Servo Lag".
- Check or adjust the following machine parameters (If you alter the machine parameters, note down the original entry values and enter them again after finishing the test.)

Parameter No.	**Entry value**	**Function**	**Original entry value**
1720	100 (mm)	servo lag monitoring EMERGENCY STOP	
1140	9.99 (V)	movement monitoring	

- Traverse those reference points that need to be traversed before those of the defective axis.
- Turn the override potentiometer of the KEYBOARD UNIT completely to the left and start reference point traverse for the defective axis.
- Check the axis enable for the defective axis at the servo amplifier.
- Check the screen display
  * (control ready for operation) must be switched on, the "F" of the feed display must be lit normally (if the display is inverse the feed enable is missing) and the symbol for "axis not in the position loop", e.g. X ■, should not follow the position display.
- Turn the override potentiometer slowly to the right and turn it back left before the servo lag display reaches the limit of the position monitoring (MP 1720).

When the override potentiometer is turned to the right, the control outputs an analog voltage which is increased proportionally to the servo lag up to 10V max. The control is operating correctly if a voltage of 10V ± 0.1V can be measured at the TEST ADAPTOR with the multimeter. If no voltage can be measured, switch off the main switch, disconnect the connector X8 from the LE, disconnect the nominal value line from the servo amplifier and test for short-circuit. If the nomial value line is in order, connect the connector X8 to the LE again (leave the nominal value line of the servo amplifier disconnected), switch on the main switch and repeat the measurement with reference mark traverse. If an analog voltage can be measured now, the control is operating correctly. If no voltage can be measured, the analog output of the LE is probably defective.

16.2.1 Checking the Analog Output: Measurement Setup



X8 Nominal Value Output 1 2, 3, 4, S (TNC 360)
1, 2, 3, 4 (TNC 306)

Flange socket with female insert (15-pin)

Pin No.	Signal Designation
1	±10V analog output 1.- axis
2	analolg input (0...4.999V) max.
3	±10V analog output 2. axis
4	±10V analog output 5. axis
5	±10V analog output 3. axis
6	0V analog output 5. axis
7	±10V analog output 4-. axis
8	±10V analog output S-axis

Pin No.	Signal Designation
9	0V analog output 1. axis
10	0V analog input
11	0V analog output 2. axis
13	0V analog output 3. axis
14	0V analog output 4. axis
15	0V analog output S-axis
12	not assigned
housing	external shield = housing

Attention:
Always switch off the main switch when engaging or disengaging any connectors.

16.3 Switching Over the Position Display

Press key	Function
MOD	Acitvate auxiliary mode "MOD"
↓ or ↑	Press key repeatedly, until the dialog POSITION DISPLAY appears
ENT	Press key, until the desired display mode (ACTL, NOML, LAG, DIST) appears.
END	Exit auxiliary mode

16.4 Feed Adjustment

Check/adjust the machine parameters (note down the original values before changing).

Parameter No.	Entry Value	Function	Original Entry Value
1390	0	feed precontrol on	
7290	0	display step = 1 µm	

- Switch to position display to LAG (display of servo lag)

- Enter the following program (adjustment of X-axis):

```
1 LBL 1
2 X 100 R0 F 29999  M (program the traverse range with as large a value as possible)
3 X 0     R              M
4 CALL LBL 1 REP 10
```

- Run the test program in the operating mode "Program Run/Full Sequence"

- Adjust the feed at the servo-amplifier (tachometer) until the servo lag display is approx. zero for positioning in both directions

- Reset the values of the machine parameters and the position display to their original values

- Adjust the remaining axes accordingly.

16.5 Offset Adjustment

16.5.1 Offset Adjustment with Code Number

Press key	Function
MOD	Activate auxiliary mode "MOD"
↓ or ↑	Press key repeatedly , until the dialog CODE NUMBER = appears
7 5 3 6 8	Enter code number

The offset values are displayed individually for each axis in converter increments (1 converter increment = 0.61 mV).

ENT	The offset values are transferred to the offset memory and compensated.
NO ENT	The offset memory is erased and no compensation takes place.

Only the current offset is compensated by means of the code number. Subsequent offset modifications are not compensated.

16.5.2 Automatic Cyclic Offset Adjustment

In the machine parameter MP1220 the cycle time (unit [s]) is determined, after which an offset is compensated by one converter increment (0.61 mV). To switch off the automatic offset adjustment, enter the value 0 in the machine parameter MP1220.

Note:
If an offset voltage of 100 mV is reached with automatic offset adjustment, the control switches itself off, generating the error message "GROSS POSITIONING ERROR <AXIS> E".

16.5.2 Offset Adjustment at the Servo-Amplifier

Set/adjust the following machine parameters (note down the orignal values before changing a machine parameter).

Parameter No.	Entry Value	Function	Original Entry Values
1080.0 1080.1 1080.2 1080.3	0 0 0 0	integral factor X-axis integral factor Y-axis integral factor Z-axis integral factor 4. axis	
1220	0	cycle time for automatic offset adjustment	
1290	0	display step= 1 µm	
1390	0	feed precontrol on	
1510.0 1510.1 15.10.2 15.10.3	> = 1 > = 1 > = 1 > = 1	KV factor for feed precontrol	

- Switch position display to LAG (display of servo lag); (see section 16.3)

- Erase the offset memory with the code number 75 368 (see section 16.5.1)

- Select the operating mode or or .

- Adjust the offset at the servo-amplifier until the values of the individual axes are zero or oscillate symmetrically about zero.

- Reset the machine parameter values and the position display to their original values.

17. PLC Inputs and Outputs

17.1 Specifications

17.1.1 PLC-Inputs at the Logic Unit

I 0 to I 31 and acknowledgement "Control Ready for Operation" at X22 (PLC input)
I 128 to I 151at X27 (machine tool operating panel)

- Voltage ranges:
  "1"-signal: U_{emin} = 13 V; U_{emax} = 30.2 V;
  "0"-signal: U_{emin} = - 20 V; U_{emax} = 3.2 V;

- Current ranges:
  "1"-signal: I_{emin} = 3.8 mA; I_{emax} = 8.9 mA;
  "0"-signal: I_{emax} = 1.0 mA; (with U_e = 3.2 V)

Pin layout see section 6.1.3

17.1.2 PLC Outputs at the Logic Unit

O0 to O.30 and "Control Ready for Operation" at X21 (PLC output)
O0 to O7[1)] at X27 (machine tool operating panel)

"1" $U_{a\ min} = U_B$ - 3 V
$I_{a\ max}$ = 100 mA (current limit: 110 mA)

1) O0 to O7 are available at X21 and X27

17.1.3 PLC Inputs at the PL 400

I64 to I126 at X4 to X9

"0"-signal U_e = - 20 V to 4V
I_e = 1.6 mA with U_e = 4 V

"1"-signal U_e = 16.5 V to 30 V
I_e = 6.2 mA to 12.6 mA

17.1.4 PLC Outputs at the PL 400

O32 to O62 and "Control Ready for Operation" at X1 to X3

"1"-signal $U_{a\ min} = U_B$ - 3 V
$I_{a\ nom}$ = 1.2 A

Pin layout see section 6

17.2 Checking the PLC Inputs and Outputs

Three test units are available to check the inputs and outputs of the PLC:

- PLC test unit for:	X21 (PLC output at the logic unit) X22 (PLC input at the logic unit)
- Measuring adaptor[1] for:	X27 (connection of the machine operating panel at the logic unit)
- PL-test adaptor for:	X1 to X3 (PLC outputs at the PL 400) X4 to X9 (PLC inputs at the PL 400)

With the PLC test unit all inputs and outputs of a connector are displayed simultaneously. Moreover, the voltages can be measured.

1) If no PLC test unit is available, the measuring adaptor can be used for all PLC inputs and outputs of the LE.

17.2.1 PLC Inputs

The inputs are tested as follows:
a) Connect the test unit between LE and PLC or between PL and PLC.
b) Set the TNC as follows:

Press key	Function
MOD	select auxiliary mode "MOD"
↓ or ↑	press key repeatedly, until the dialog CODE NUMBER= is displayed
8 0 7 6 6 7	enter code number
ENT	activate PLC mode
↓ or ↑	select item TABLE I/O/C/T/M
ENT	activate item

Now, a table is displayed on the screen. Press ENT until the table INPUT is displayed. The logic states of the inputs are displayed on the screen. The states of the screen display must correspond to those of the test unit. If there is a difference, measure the voltage level (see section 17.1) of this input at the TEST UNIT. If the input voltage is correct, the input board is probably defective (I0 to I31 and I128 to I151 PLC-board I64 to I126 I/O-board PL 400).

ENT ENT	exit PLC mode

Note:
Always switch off the main switch, when engaging or disengaging any connectors.

17.2.2 PLC-Outputs

The PLC outputs are tested as follows:
a) Connect the test unit between LE and PLC or between PL and PLC.
b) Set the TNC as follows:

Press key	Function
MOD	activate auxiliary mode "MOD"
↓ or ↑	press key repeatedly, until the dialog CODE NUMBER= is displayed
8 0 7 6 6 7	enter code number
ENT	acitvate PLC-mode
↓ or ↑	select item TABLE I/O/C/T/M
ENT	acitvate item

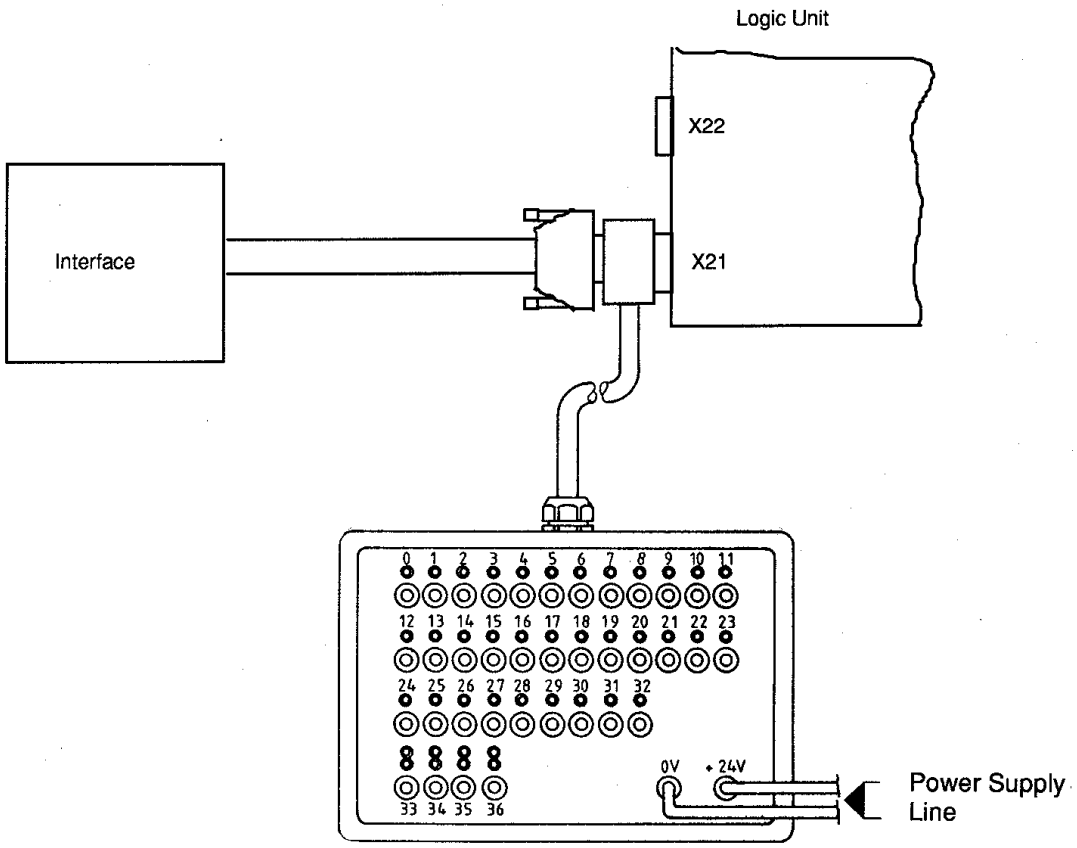
Now, a table is displayed on the screen. Press ENT until the table OUTPUT is displayed. The logic states of the outputs are displayed on the screen. The states of the screen must correspond to those of the test unit. If there is a difference, check the connecting cable for short circuit and measure the output current of this output at the interface (max. 100 mA for the LE, max. 1.2 A for PL outputs). If the output current is not exceeded and the connecting cable is in order, the output board is probably defective. (O0 to O30 PLC-board, O32 to O62 I/O-board PL 400)

END END	exit PLC mode

Note:
Always switch off the main switch, when engaging or disengaging any connectors.

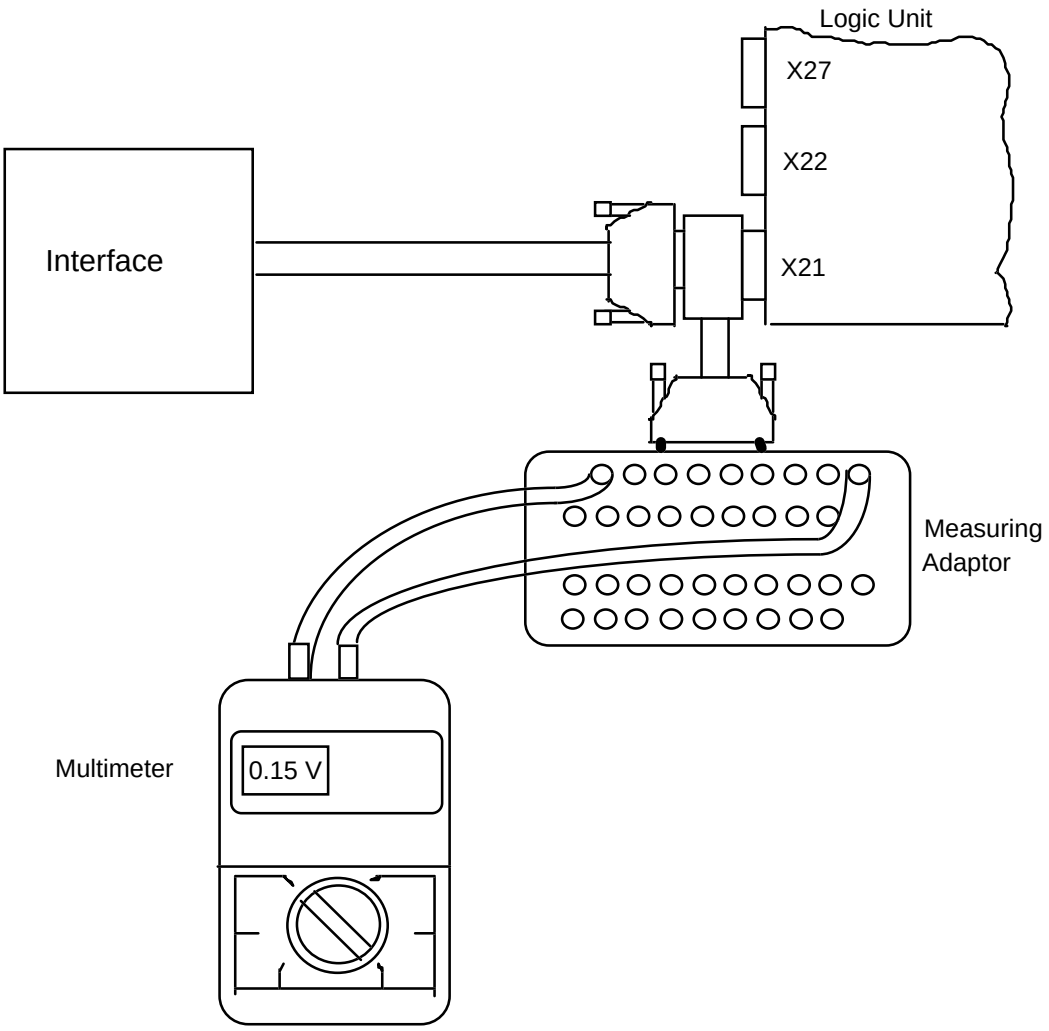
17.2.3 Measurement Setup for PLC Inputs and Outputs at the Logic Unit

a) With the PLC-test unit



X21 : PLC output
X22 : PLC input

b) With universal measuring adaptor



X21 : PLC output
X22 : PLC input
X27 : Machine tool operating panel

17.3 Further Diagnosis Possiblities in the PLC Mode

17.3.1 TRACE Function

Function:
The logic states of up to 16 operands (M, I, O, T, C) can be displayed graphically on the screen at the same time. 1 024 PLC-scans can be traced.

Press key	Function
MOD	Activate auxiliary mode "MOD"
↓ or ↑	Press key repeatedly, until the dialog CODE NUMBER= is displayed
	Enter code number
ENT	Activate PLC mode
ENT	Call TRACE function
↓ or ↑ ENT	Select and call item SELECT I/O/C/T/M

A table is displayed from which the desired operands can be selected.

The control requests the positions of the table in a dialog. Wrong inputs can be erased by pressing DEL □.
It is possible to enter a trigger condition for each operand. 512 states are traced before and after a trigger event. The following trigger conditions are possible:

"1" ⇒ trace if operand is a logical "1"
(trigger on positive edge)
"0" ⇒ trace if operand is a logical "0"
(trigger on negative edge)
⇒ no trigger
If no trigger condition is entered for any of the operands, the operand states are traced continuously and the last 1024 states are stored.

e.g.: 0 I5 1 ⇒ trigger on pos. edge
1 O6 0 ⇒ trigger on neg. edge
2 M7 ⇒ no trigger

END □	Exit to TRACE menu
↓ or ↑ ENT	Select and activate item START TRACE (PCTR blinking in the status window)

The trace function is started with START TRACE; END TRACE or a trigger event end the tracing.
PCTR blinking : trigger condition has not occured yet
PCTR on : trigger condition has occured, write access to buffer memory
PCTR off : buffer memory is full, LOGIC DIAGRAM can be called

↓ or ↑ ENT	Select item DISPLAY TRACE BUFFER and call LOGIC DIAGRAM

17.4 Output "Control Ready for Operation" and Acknowledgement for Test "Control Ready for Operation"

Important functions are monitored by the TNC 306/360 by way of a self-diagnosis system (electronic assemblies such as the micro-processor, the ROM, read-write memory, positioning systems, encoders etc.).

If an error is detected, a blinking error message is displayed in plain language in the dialog line. As soon as this error is displayed, the output "Control Ready for Operation" becomes inactive.

By switching off the main switch or by pressing END, this state can be cancelled, if the error cause has been eliminated.

The output "Control Ready for Operation" is to switch off the control voltage of +24V in the machine tool interface. Since this function is an important safety function, the switch-off function of the output "Control Ready for Operation" is tested via the input "Acknowledgement Control Ready for Operation" every time the control is switched on.

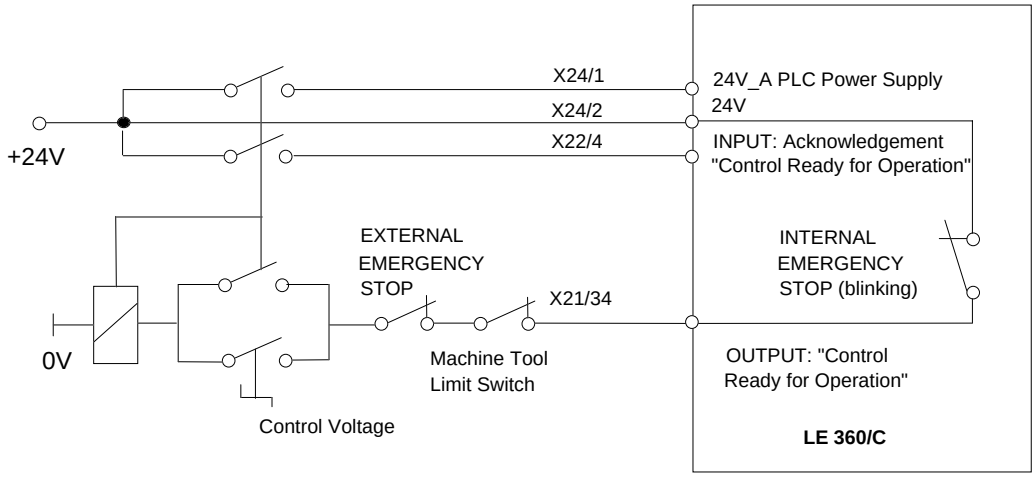
The TNC 306/360 comprises a monitoring system that is tested when the machine tool is switched on.

If the +24V at the input "Acknowledge Control Ready for Operation" are missing during the test routine when the control is switched on, the error message "RELAY EXT. DC VOLTAGE MISSING" is generated. If, however, the acknowledgement is switched off to late or not switched off at all after switch-off of the output, the blinking error message "EMERGENCY STOP DEFECTIVE" is displayed.

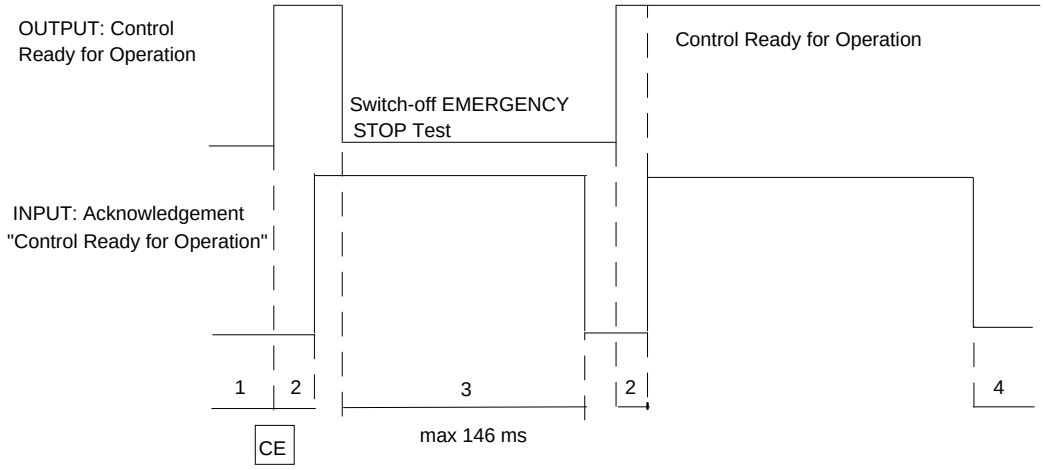
If the control detects an error during the switch-on test routine, a bridge can be inserted between the outputs "Control Ready for Operation" and "Acknowledge Control Ready for Operation" (disconnect the wires) in order to determine whether the defect is due to the control or to the interface. If the error is still present after inserting the bridge and with correct power supply of the PLC-part, the defect is located in the LOGIC UNIT. If, however, the error does not occur any longer after the bridge has been inserted, the interface is defective.

Attention!
Do not forget to remove the bridge and to install the standard operating state after the test!

17.4.1 Wiring of the EMERGENCY-STOP Interface (Basic Circuit Diagram)



17.4.2 EMERGENCY-STOP Flow Diagram TNC 306/360



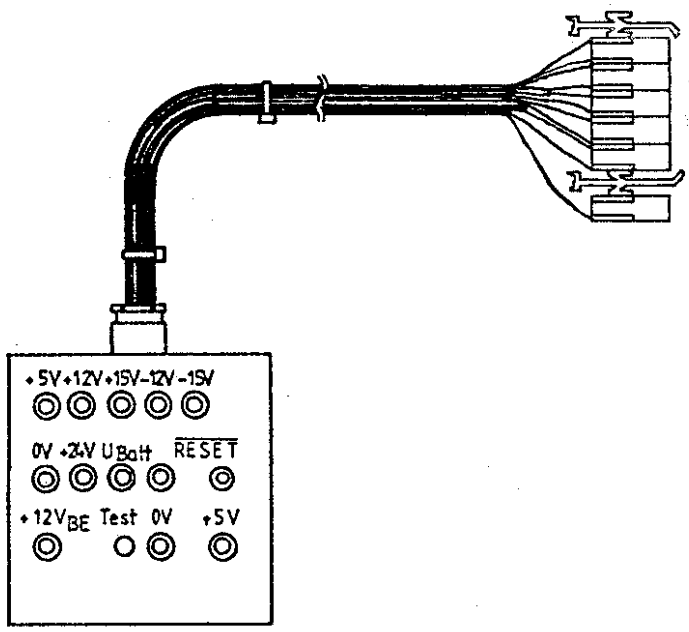
Time	Remark	Error Message
1		**POWER INTERRUPTED**
2	Waiting for control voltage	**RELAY EXT. DC VOLTAGE MISSING**
3	After switching off the output "Control Ready for Operation", the acknowledgement "Control Ready for Operation" must be switched off within 146 ms; otherwise the blinking error message is generated.	**EMERGENY-STOP DEFECTIVE**
4	If the acknowledgement is switched off during operation, the error message is displayed.	**EMERGENCY STOP**

18. TEST UNITS

18.1 Test Load Unit , Id.No. 247 358 01

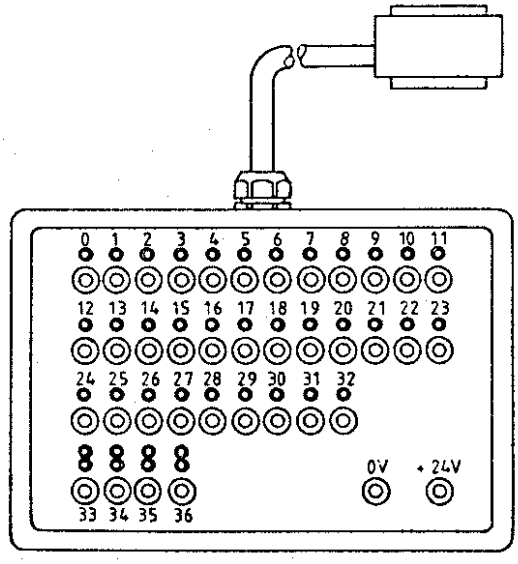
(is currently being redesigned)

Used:
- to test the "POWER SUPPLY" assembly (see section 8.4)



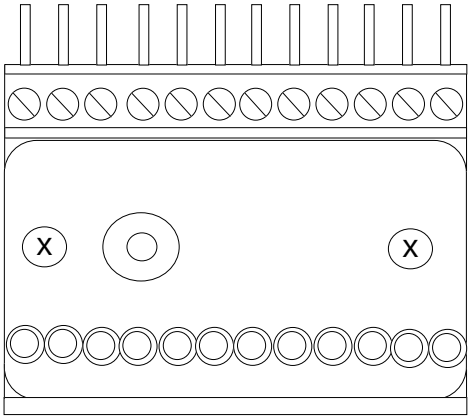
18.2 PLC Test Unit, Id.No. 247 361 01

Used:
- to test the PLC inputs and outputs at the LE (see section 17.2)



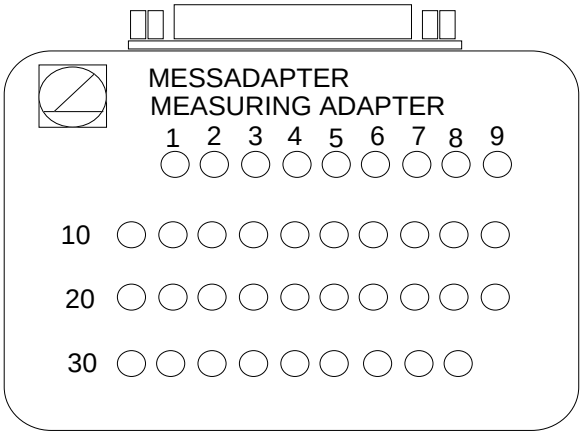
18.3 PL Test Unit, Id.No. 247 359 01

Used:
- to test the PLC inputs and outputs at the PL (see section 17.2)

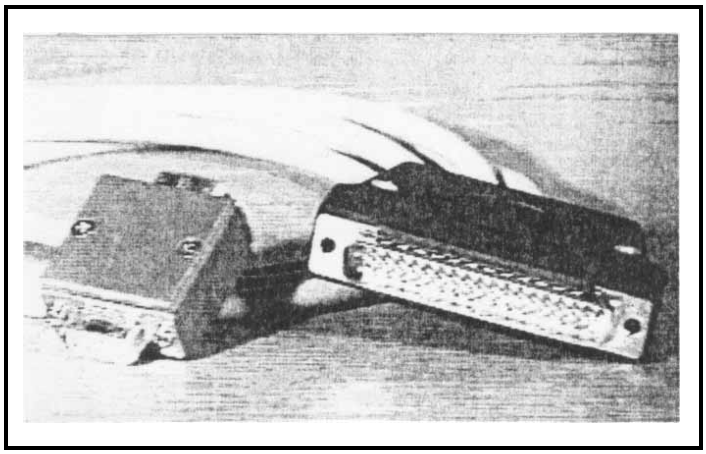


18.4 Measuring Adapter, Id.No. 255 480 01

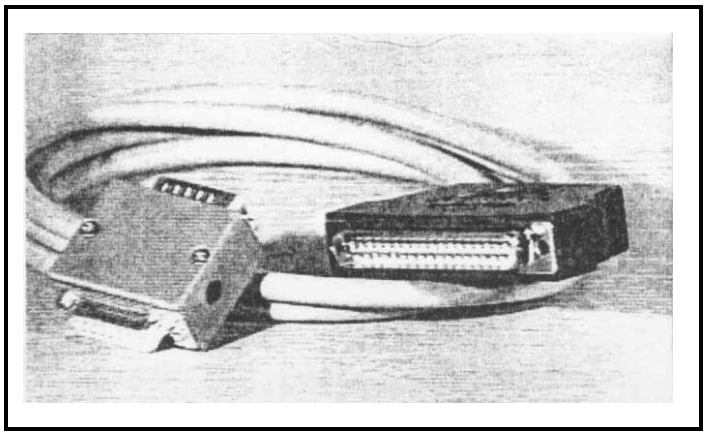
Used:
- to test the keyboard (see section 9.2)
- as a universal test unit for D-Submin connectors, 9pin to 37pin



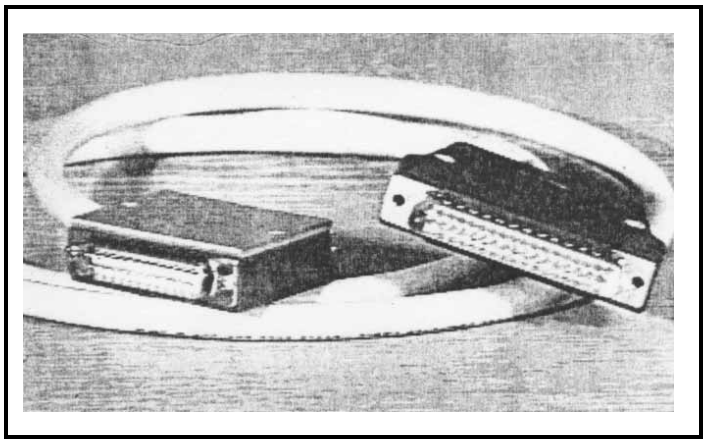
Note:
Adaptor cables are required for each connector size, as described on the following page.



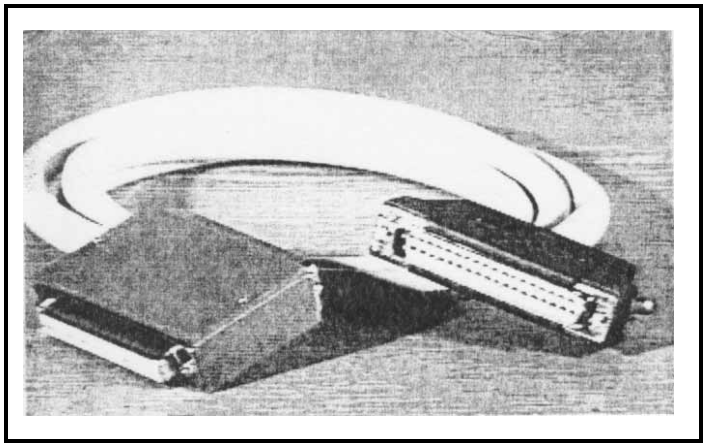
Adaptor Cable,9pin
Id.No. 255 481 01



Adaptor Cable, 15pin
Id.No. 255 482 01



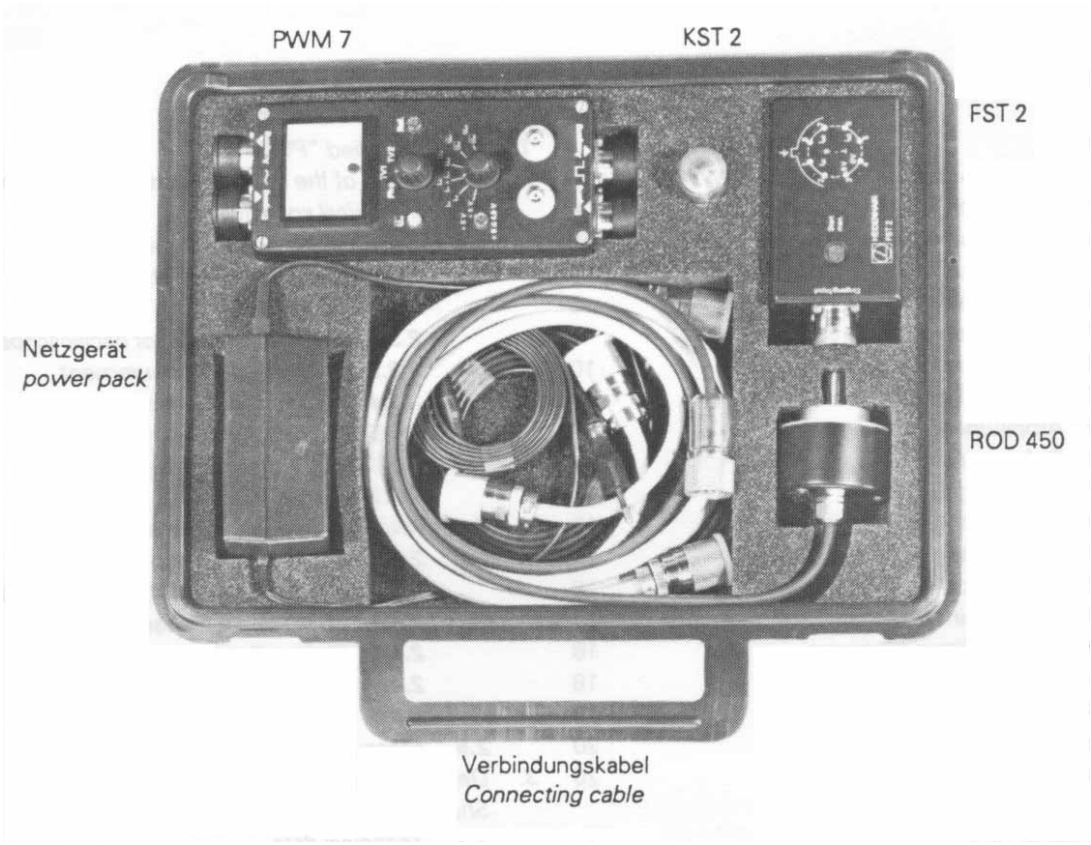
Adaptor Cable, 25pin
Id.No. 255 483 01



Adaptor Cable, 37pin
Id.No. 255 484 01

18.5 Encoder Diagnostic Set, Id.No. 254 599 02

Used:
- to test the electrical functions of an encoder
  (further information please see from the operating instructions of the Diagnostic Set)



19. Exchange Instructions

19.1 General Remarks

19.1.1 Equipment Required

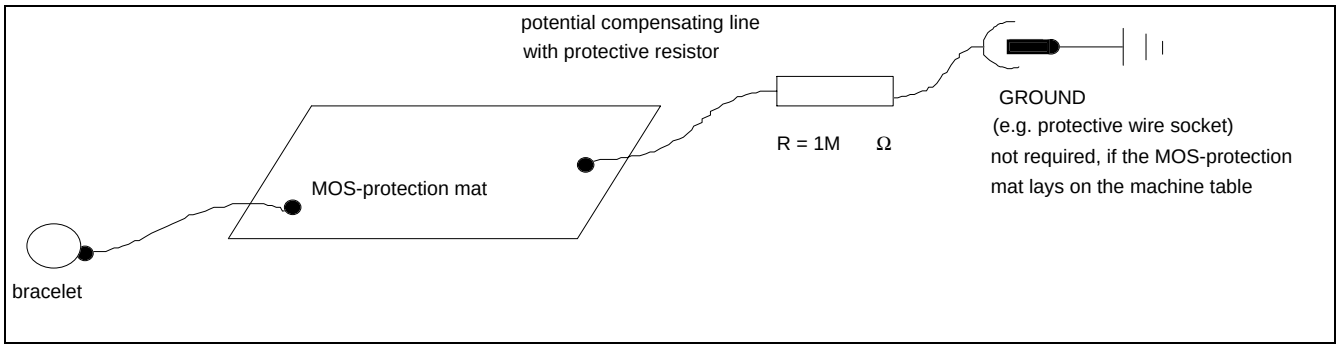
1 external data medium, e.g. FE 401/B or personal computer with connecting cable
1 tool set (screw driver, socket wrench etc.)
1 MOS-protection device (only required for exchanging boards or EPROMs)

19.1.2 MOS-Protection

If the processor board, the PLC-board or EPROMs are to be exchanged, a MOS-protection is definitely required, as otherwise MOS-components on the board or EPROMs may be destroyed.

Note:
Avoid any unprotected handling and any contact of the boards or EPROMs with statically charged objects (packing material, storage, ...)

MOS-Protection



19.1.3 Software Compatibility

Exchange units (complete LOGIC UNIT) are generally supplied with the latest software version.
Exchange boards, however, are always supplied **without** software and **without** software-enable module.
For this reason, the EPROMs and the software enable module of the defective board must be inserted into the exchange board at site. (Before sending us exchange boards for repair, always remove the EPROMs and the software enable module!)

19.1.4 Backing up RAM Data

Before the complete LOGIC UNIT, a board or an assembly are exchanged, or before a software exchange, all data of the RAM must be stored on an external data medium.

- The machine parameters and the part programs are always processed in the RAM and must be backed up on an external data medium.

- If the value of the machine parameter MP4010 is 1, the PLC program parts are processed from the RAM and must be backed up (see section 15.2).

Parameter-No.	Entry Value	Function
4010	+0 = EPROM mode +1 = RAM mode	PLC program from the RAM or from the EPROM

- If the machine parameter MP730 is not 0, the multipoint axis error compensation is active for one or more axes. In this case, the "Compensation Value List" needs to be backed up as well (see section 15.2).

Parameter-No.	Entry Value	Function
730	0 ... 15	multipoint axis error compensation
Bit 0 1 2 3	 + 0 → inactive + 1 → active + 0 → inactive + 2 → active + 0 → inactive + 4 → active + 0 → inactive + 8 → active	 X-axis Y-axis Z-axis IV-axis

- If the machine parameter MP7260 is not 0, a central tool memory exists. The tool data stored in the NC program No. 0 need to be backed up, too (see section 15.2).

Parameter-No.	Entry Value	Function
7260	0 → no central tool memory 1 ... 99 = central tool memory entry value = number of tools	central tool memory

Note:
For reasons of safety, the machine parameters, the compensation value list (if active) and the PLC program (if MP4010 = 1) should always be stored on an external data medium. The procedure for data backup is described in section 15.2.

19.1.5 Determining Data for the Supplementary Operating Modes:

If the "PROCESSOR BOARD" assembly or the complete "LOGIC UNIT" are to be exchanged, or if a software exchange is to be carried out, the preset values and the current entry values of the auxiliary operating modes should be determined, so that they can be re-entered after the exchange.

TNC Dialog Display	**Press Key**	**Remarks**
MEMORY TEST	-	
POWER INTERRUPTED	CE	
RELAY EXT. DC VOLTAGE MISSING		Switch on control voltage
TRAVERSE REFERENCE POINTS <1. AXIS> <2. AXIS> • •	MOD	Do not yet traverse the reference points!
FREE MEMORY = XXXXX	↓	
PROGRAM INPUT: XXXXXXXXXX 0 HEIDENHAIN 0 ISO	↓	Note down the format in which the NC-programs have been entered
CHANGE MM/INCH	↓	
POSITION DISPLAY 0 0 0 0 0 ACTL REF LAG NOML DIST	↓	Note down the current setting for the position display, then switch to ACTL by pressing ENT
ACTL X		Note down the preset values (Do not forget the algebraic signs)
ACTL Y		
ACTL Z		
ACTL IV		
POSITION DISPLAY LARGE/SMALL	↓	
BAUD-RATE =	↓	Note down the Baud rate
RS232-C INTERFACE = ME 0 FE 0 EXT 0		Note down the operating mode of the RS232-C interface

TNC Dialog Display		Press Key	Remarks
LIMIT X+	=	↓	Note down the limit values (Do not forget the algebraic signs!)
LIMIT X-	=	↓	
LIMIT Y+	=	↓	
LIMIT Y-	=	↓	
LIMIT Z+	=	↓	
LIMIT Z-	=	↓	
LIMIT IV+	=	↓	
LIMIT IV-	=	↓	
NC: SOFTWARE-NUMBER		↓	
PLC: SOFTWARE-NUMBER		↓	
		END	

19.1.6 Labelling the Connecting Cables:

If the connecting cables are labelled incompletely or not at all, they have to be marked such that the correct plug connections can be re-established after the exchange of the LOGIC UNIT or of another assembly.
Pin layout: see section 6

Warning!
Switching the connecting cables may destroy the unit!

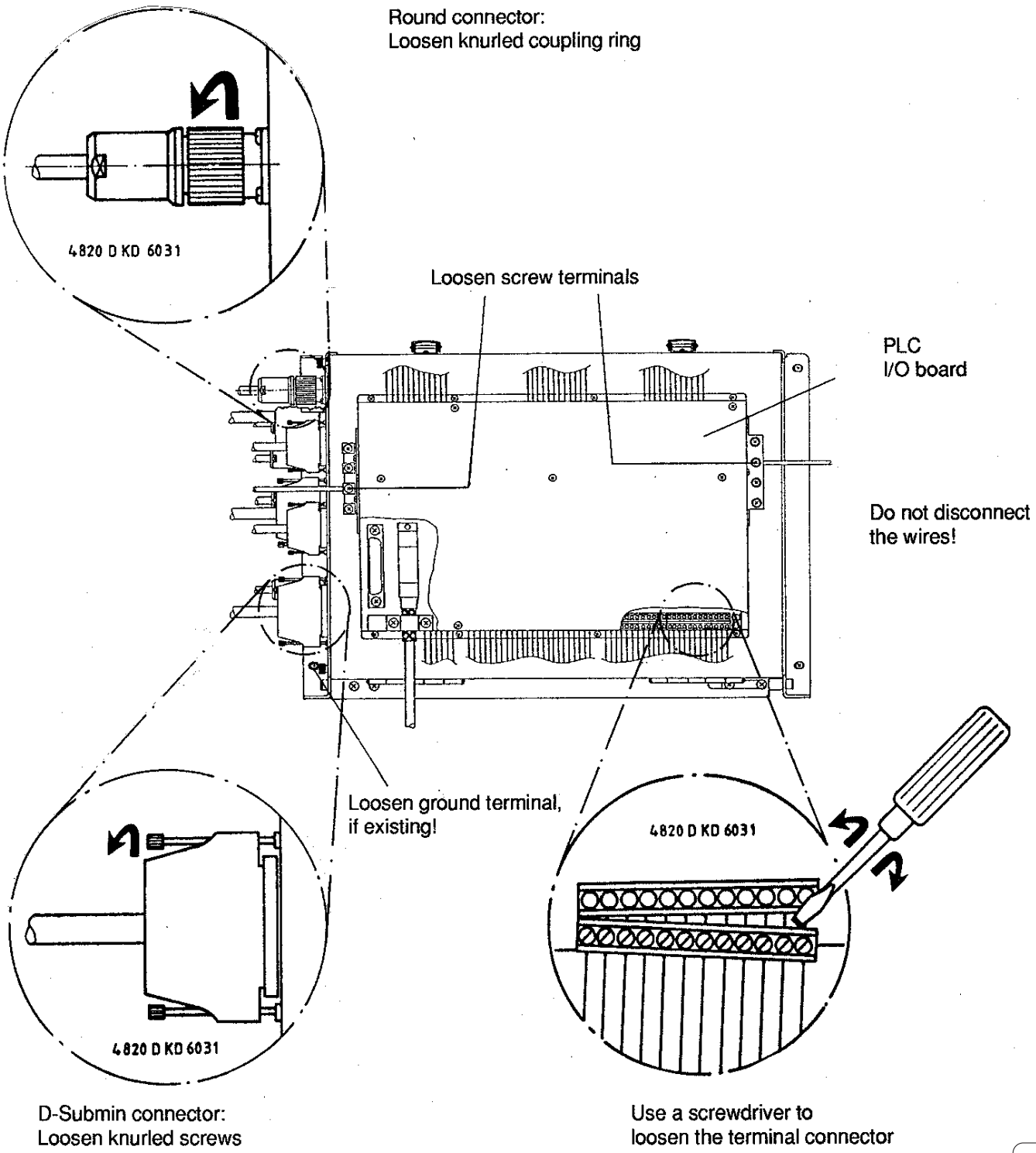
19.2 Exchanging the LOGIC UNIT

19.2.1 Data Backup and Labelling of the Cables

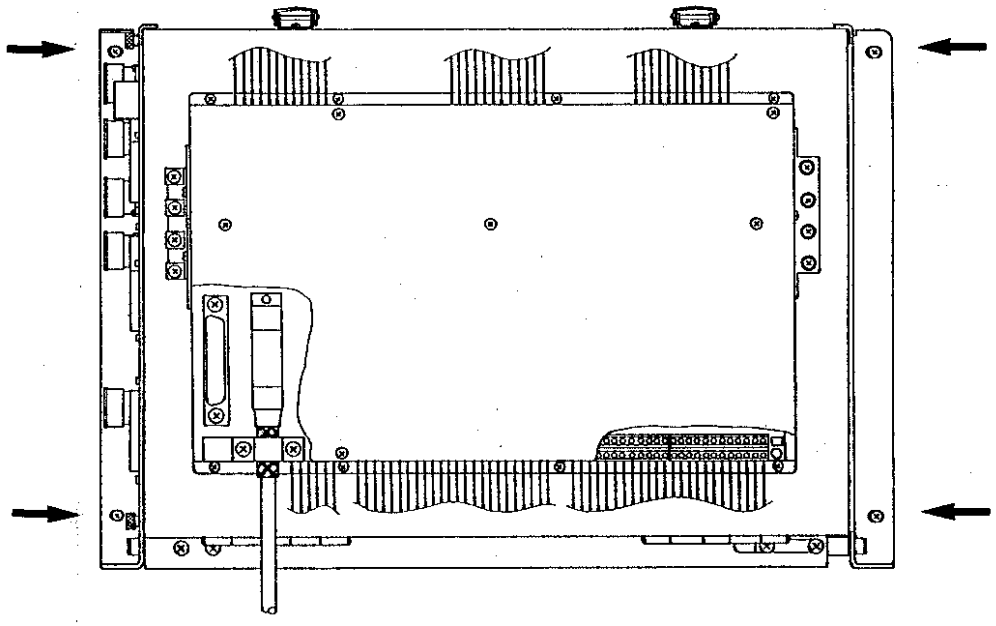
(see section 19.1)

19.2.2 Dismounting the LOGIC UNIT

a) Switch off the main switch
b) Loosen all plug connectors and clamped joints at the LOGIC UNIT
(pin layout: see section 6)



c) Loosen the 4 mounting screws on the LOGIC UNIT



d) Remove the old LOGIC UNIT and insert the new LOGIC UNIT.

19.2.3 Mounting the LOGIC UNIT

The LOGIC UNIT is mounted in the reverse order that it was dismounted:
a) Insert the LOGIC UNIT and secure it
b) Engage the connectors

Observe that no connectors are switched!

c) Switch on the main switch.
d) Read-in the machine tool data that have been backed up before the exchange (machine parameters, PLC program, NC programs and tables)
e) Enter preset values and supplementary operating modes from the table in section 19.1.5 (**before** ref. mark traverse)
f) Carry out offset adjustment with the code number (see section 16.5.1)

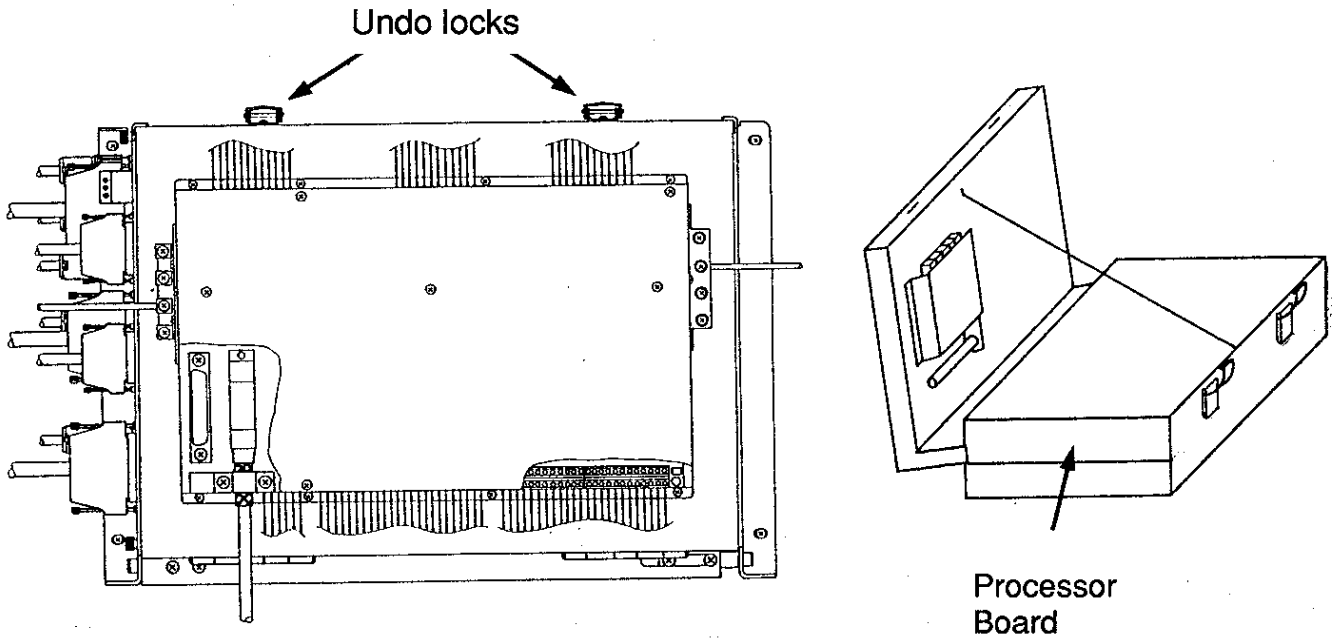
Exchange is now finished.

19.3 Exchanging the PROCESSOR BOARD

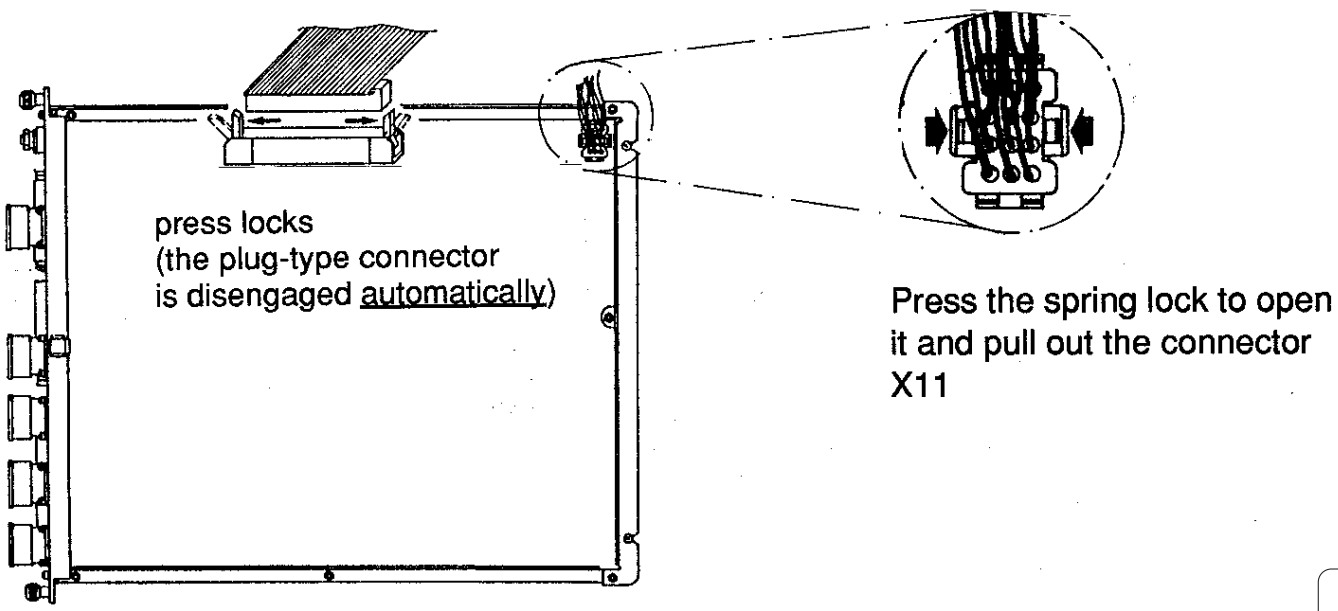
19.3.1 MOS-Protection, Software, Data Backup and Labelling of the Cables (see section 19.1)

19.3.2 Dismounting the PROCESSOR BOARD

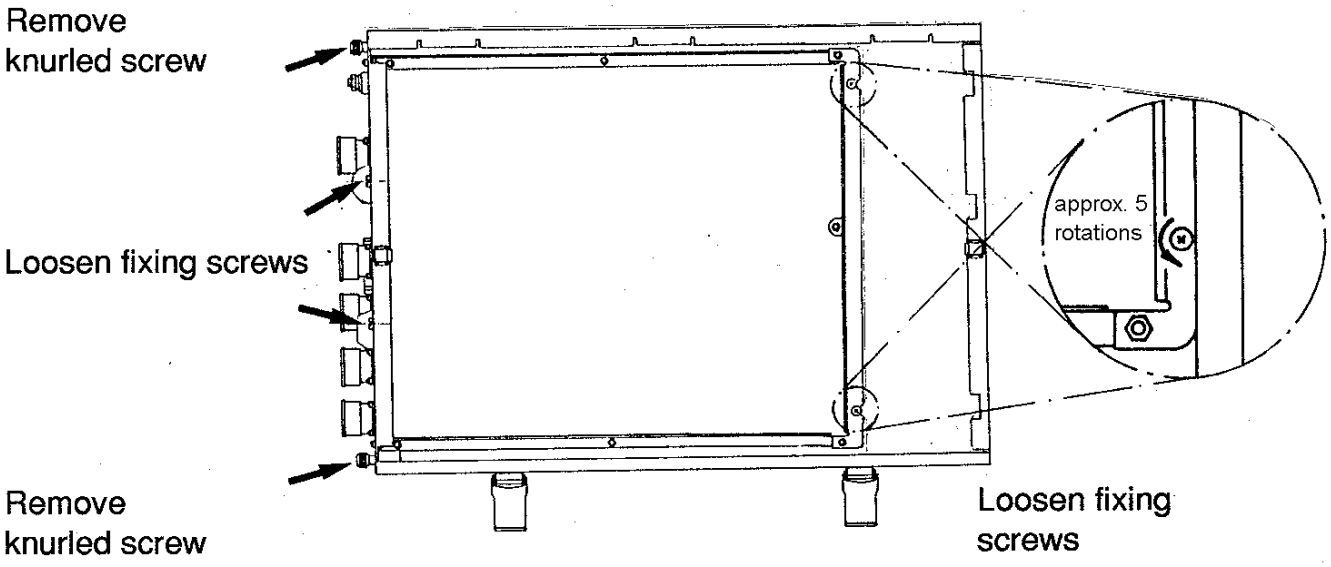
a) Switch off the main switch at the machine tool.
b) Loosen the connectors at the PROCESSOR BOARD (X1 to X12).
(if required, loosen also the screw terminals at the PLC I/O board)
Pin layout: see section 6
c) Undo the locks and open the LOGIC UNIT



d) Disengage internal connectors



e) Loosen/remove the fixing screws



f) Lift out the PROCESSOR BOARD; exchange the EPROMs, if required (see section 19.7). Insert the new board.

19.3.3 Mounting the PROCESSOR BOARD

The PROCESSOR BOARD is mounted in the reverse order that it was dismounted:

a) Insert and secure the PROCESSOR BOARD
b) Engage the connectors.

Observe that no connectors are switched!

c) Close the LOGIC UNIT and close the locks
d) Switch on the main switch
e) Read-in the machine tool data that have been backed up before the exchange (machine parameters, PLC program, NC programs etc.)
f) Enter preset values and supplementary operating modes from the table in section 19.1.5 (**before** ref. mark traverse)
g) Carry out offset adjustment with code number (see section 16.5.1)

Exchange is now finished.

Note:
Send and store the boards only in the **original packaging** that protects them from aquiring static charge.

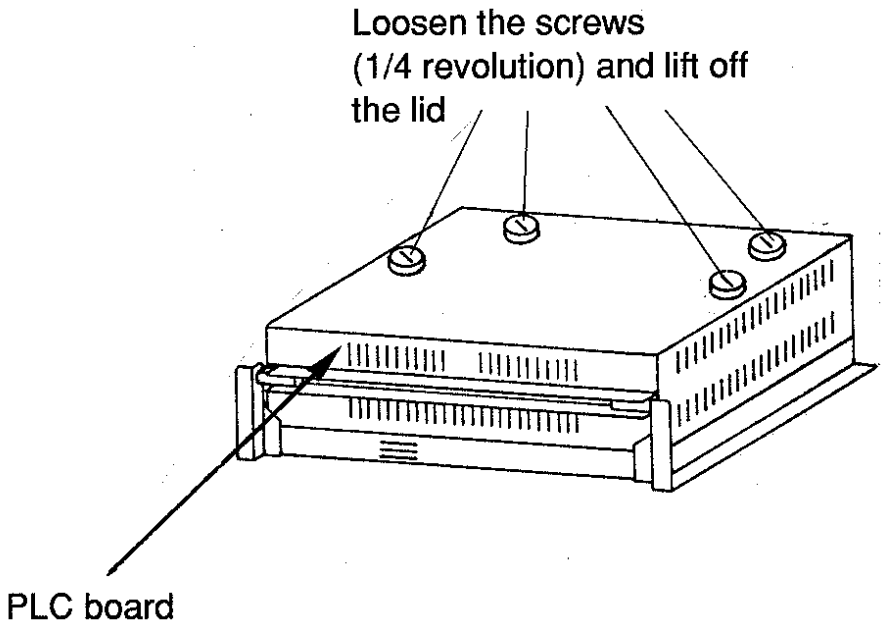
Never use conventional plastics to wrap the boards in!

19.4 Exchanging the PLC Board

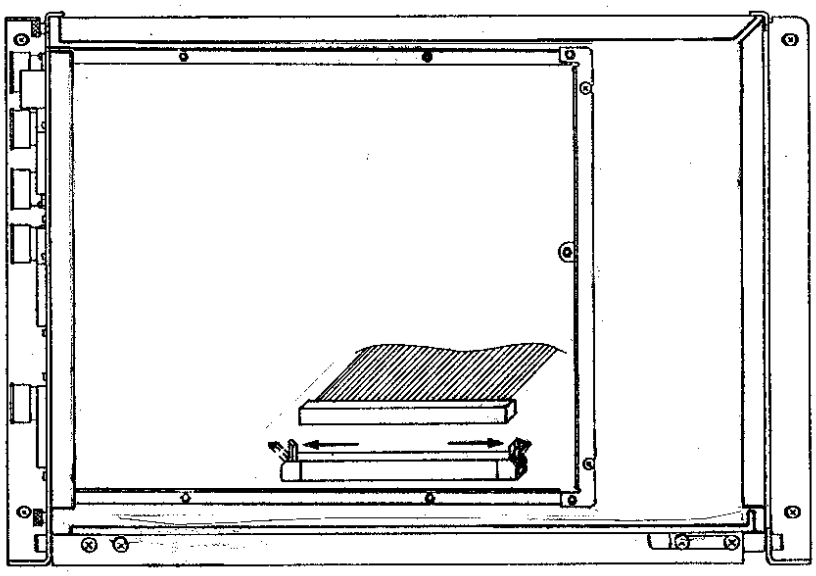
19.4.1 MOS-Protection and Labelling of the Cables (see section 19.1)

19.4.2 Dismounting the PLC Board

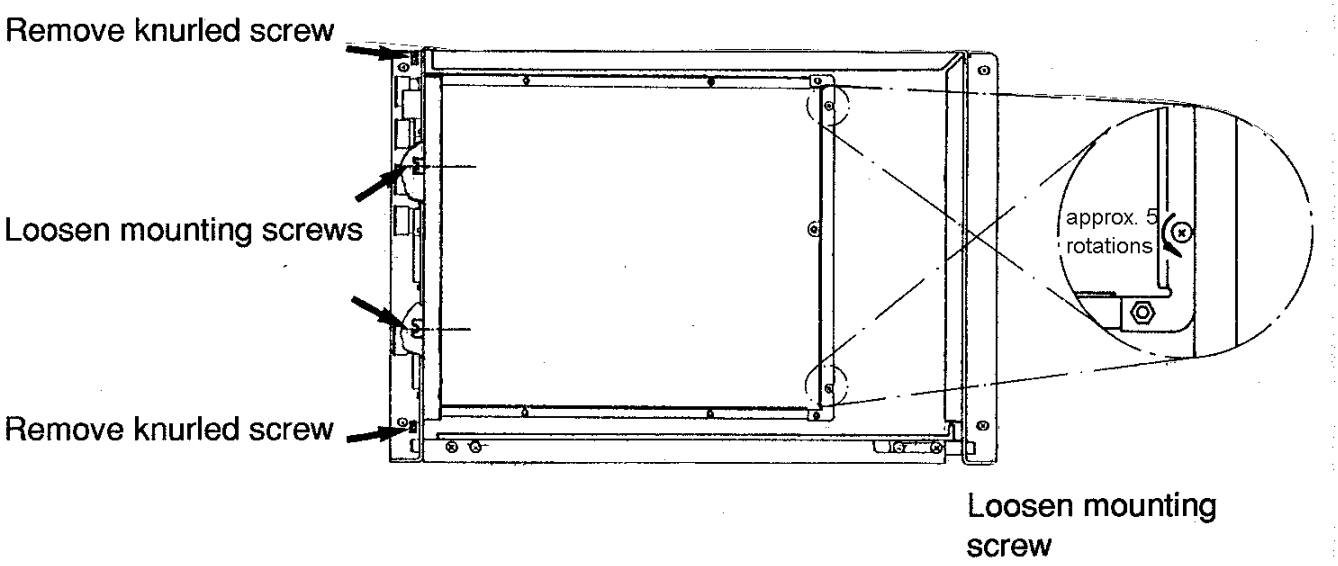
a) Switch off the main switch at the machine tool
b) Loosen the plug connections and clamped joints at the PLC board (X21 to X27).
Pin layout: see section 6
c) Loosen the screws



d) Loosen internal plug connections



e) Loosen/remove the mounting screws



f) Lift out PLC board

19.4.3 Mounting the PLC-Board

The PLC BOARD is mounted in the reverse order that it was dismounted:

a) Insert and secure the PLC-BOARD

b) Engage the connectors

Observe that no connectors are switched!

c) Fasten the lid screws
d) Switch on the main switch
e) Carry out the offset adjustment with code number (see section 16.5.1)

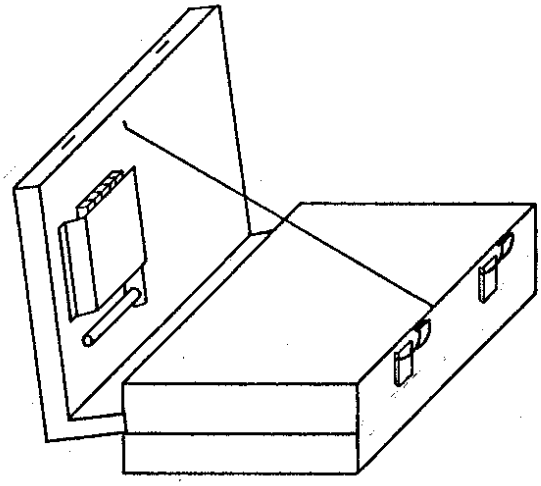
Exchange is now finished.

Note:
Send and store the boards only in the **original packing** that protects them from aquiring static charge!

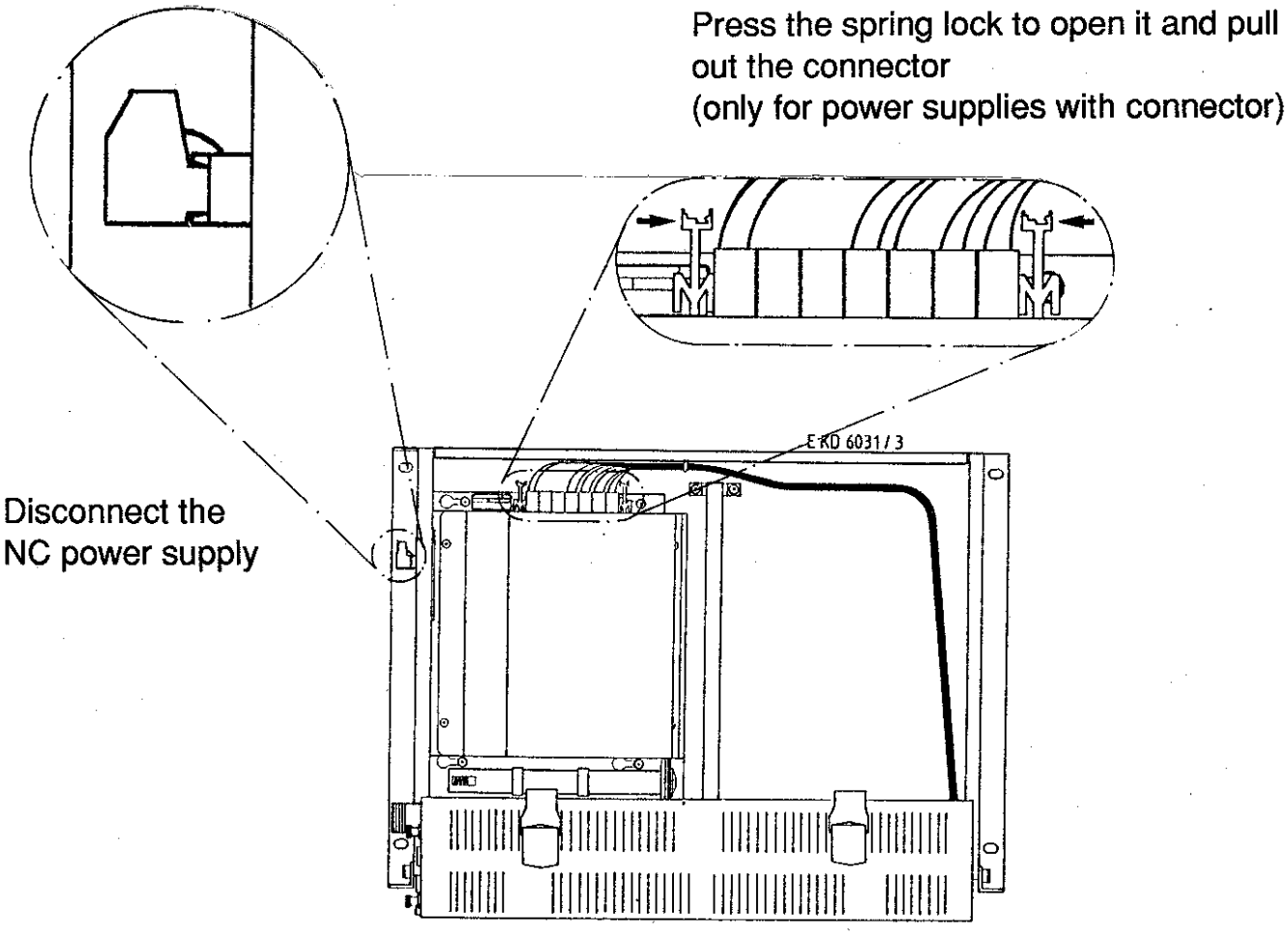
Never use conventional plastics to wrap the boards in!

19.5 Exchanging the "POWER SUPPLY" Assembly

a) Switch off the main switch at the machine tool
b) Open the LOGIC UNIT



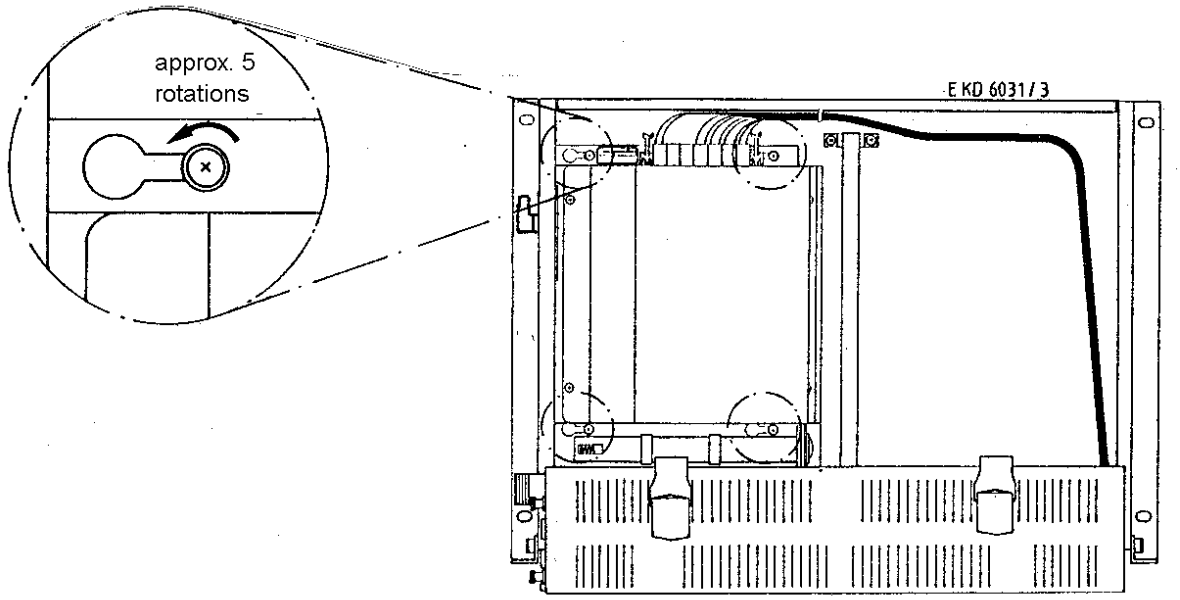
c) Loosen the plug connections and the clamped joints


Press the spring lock to open it and pull out the connector
(only for power supplies with connector)
Disconnect the NC power supply
ERD 6031/3

Note:
For power supplies without connectors, the connector X11 on the processor board must be disconnected (see section 19.3) instead of the connector at the power supply unit (power supply unit lacks connector, see section 8.3)

d) Loosen the mounting screws

Slide out the power supply unit to the right and insert the new power supply unit.



e) Fasten the mounting screws, engage the conntectors again.

Observe that no connectors are switched!

f) Close the LOGIC UNIT, switch on the main switch.

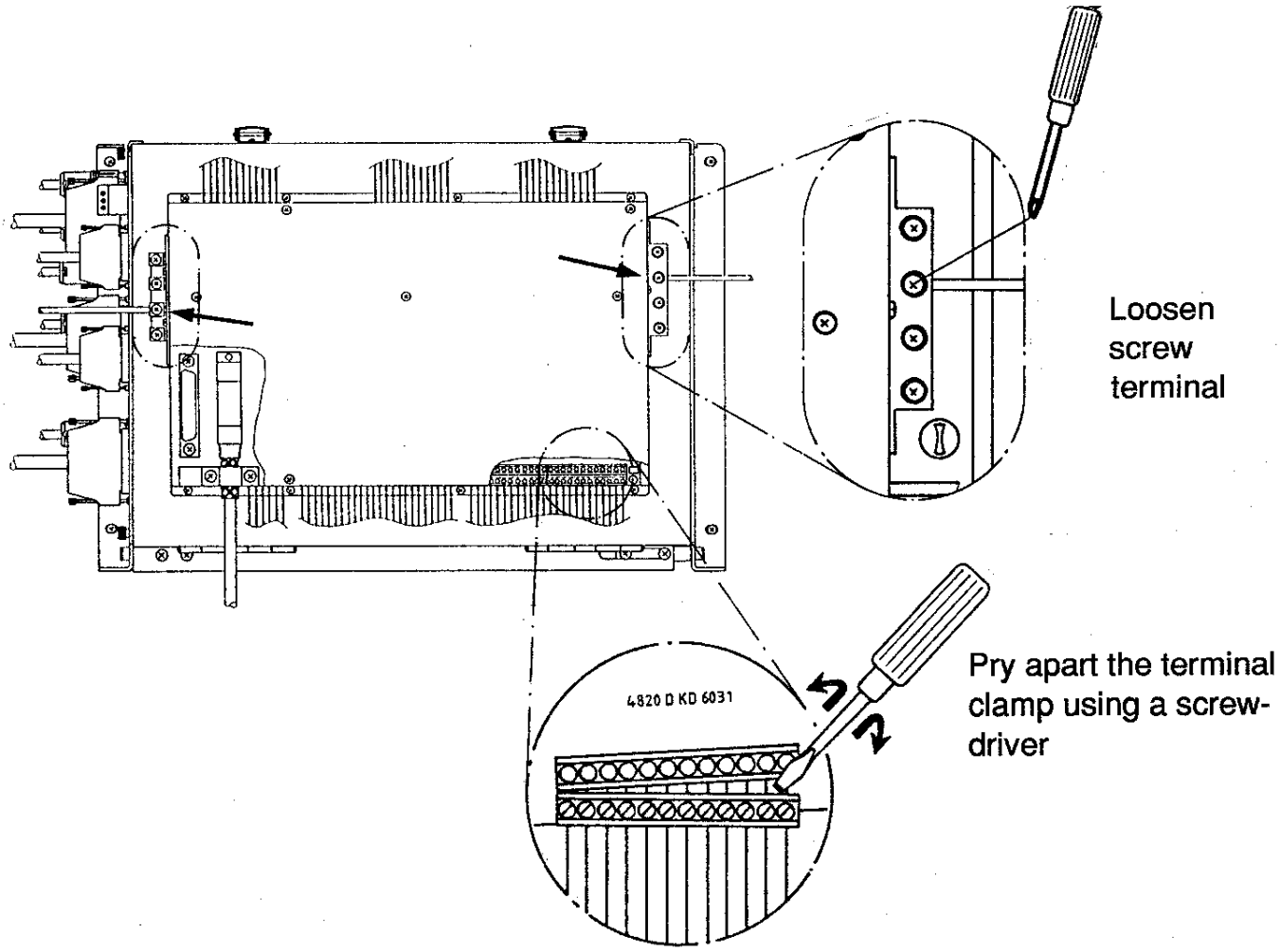
Exchange is now finished.

Note:
Send and store the boards only in the **original packaging** that protects them from aquiring static charge.

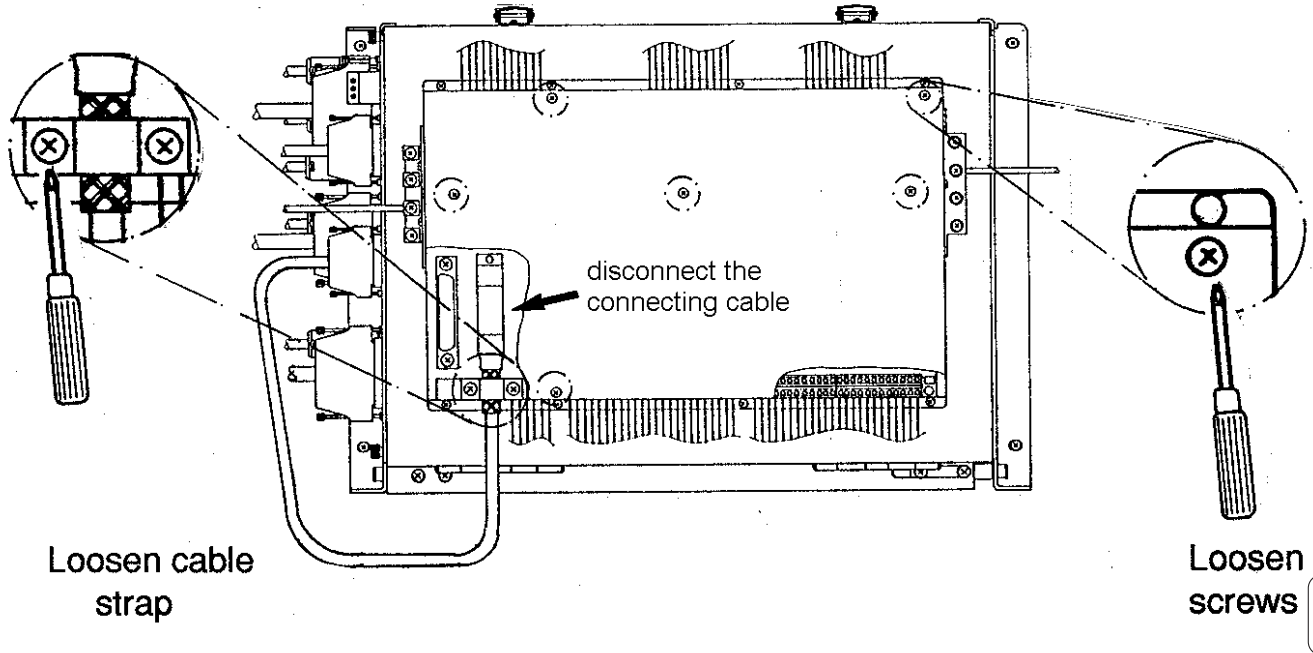
Never use conventional plastics to wrap the boards in!

19.6 Exchanging the PLC I/O Board PL400

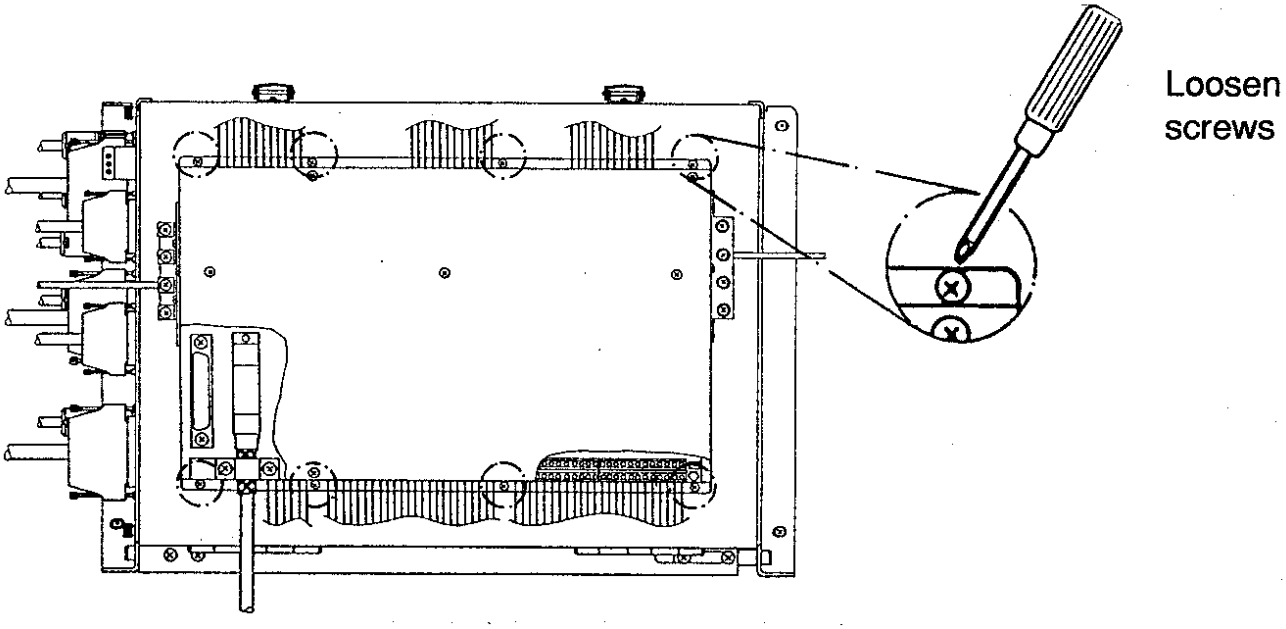
a) Switch off the main switch
b) Loosen the plug connections and the screw terminals at the PLC I/O board



c) Loosen the screws from the cover of the PLC I/O board, remove cover and disconnect the connecting cable to the PLC board from the PLC I/O board.



d) Loosen the screws and remove the PLC I/O board from the LOGIC UNIT



e) The new PLC I/O board is mounted in reverse order:
- Mount the PLC I/O board to the LOGIC UNIT.
- Connect the PLC I/O board to the PLC board.
- Engage the connectors.
- Switch on the main switch.

Exchange is now finished.

Note:
Send and store the boards only in the **original packaging** that protects them from aquiring static charge.

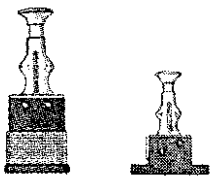
Never use conventional plastics to wrap the boards in!

19.7 Exchanging EPROMs

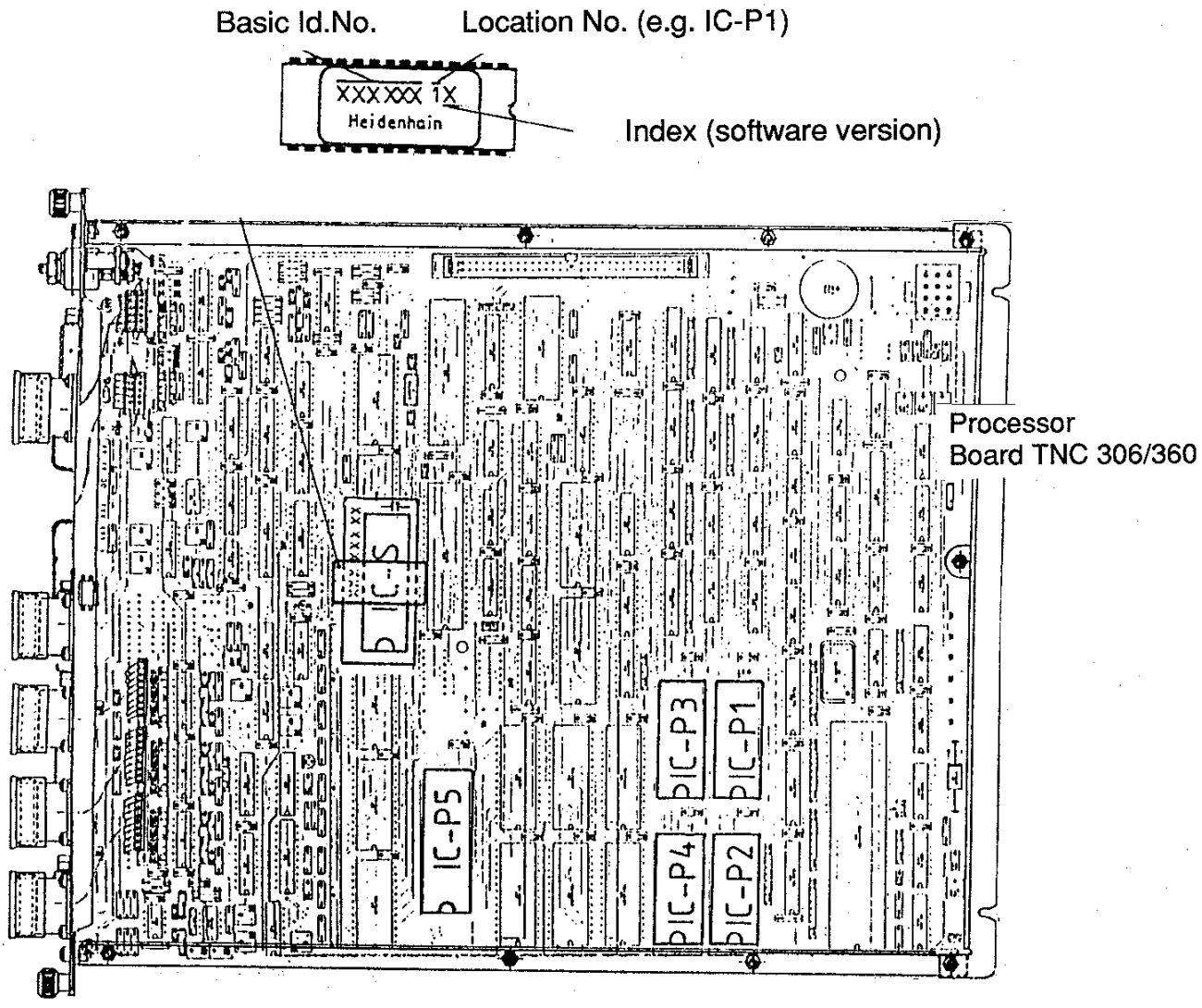
19.7.1 MOS-Protection

For the exchange of EPROMs MOS-protection is indispensable, as otherwise the EPROMs could be destroyed by static charge.
Moreover, all data should be backed up (see section 19.1).
Observe the mark on the EPROMs (do not turn it by 180°); be sure not to damage any components during the exchange. Use an appropriate tool.
After the software exchange, the LOGIC UNIT must be marked with the new NC-software number (see section 5.1). Moreover, an offset adjustment with the code number should be carried out (see section 16.5.1).

e.g. IC drawing punch and insertion tool



19.7.2 EPROM Designation



20. Machine Parameters

The following list contains the machine parameters of all software versions. However, as some machine parameters are not valid for certain controls or have been introduced/eliminated with a certain software version, columns with symbols for differentiation have been added after the parameter numbers.

Meaning of the Symbols:

♦ = With this control, the machine parameter is valid for all software versions.

04 = The machine parameter has been introduced with a certain software version (e.g. **04** means introduction with software version **04**).

I04 = The machine parameter has been eliminated starting with a certain software version (e.g. **I04** means elimination as of software version **04**), or it has been replaced by another parameter.

\- = This machine parameter is not available with this control.

* = The machine parameter is accessible via the code number 123.

Structure

The machine parameters are subdivided into groups.
Due to the structure of the parameter numbers, the list can be expanded easily.

0-999	Encoders and machine tool axes: allocation, evaluation, compensation
1000	Positioning
1400	Operation with feed precontrol
1700	Operation with servo lag
3000	Spindle control
4000	Integrated PLC
5000	Adaptation of the data interface
6000	Measurement with 3D-touch probe system
6200	Digitizing with 3D-touch probe system (only if software enable module inserted)
7100	Tapping
7200	Display and programming
7320	Colour allocation for colour screens
7330	User-parameters
7400	Processing and program run
7600	Hardware

MACHINE PARAMETER LIST

(Excerpt from the Repair Handbook TNC 306/360/2500/ CNC 234/306, sec. 26.2)

Schlüsselzahlen

123	EDITIEREN DER MASCHINEN-PARAMETER FUER ENDKUNDEN (sind mit * gekennzeichnet)
75368	OFFSETABGLEICH
86357	AUFHEBEN LÖSCH- UND EDITIERSCHUTZ
95148	MASCHINEN-PARAMETER-MODE
105296	KORREKTURWERT-LISTE
531210	RÜCKSETZEN M 1000 BIS M 200 UND BYTE 0 BIS 127
620159	EINLESEN BURN-IN PROGRAMM
807667	PLC-MODE
857282	SOFTWARE-UHREN

Maschinen-Parameter

Die Maschinen-Parameter sind in nachfolgender Liste für alle Software-Varianten aufgeführt
Da aber einige Maschinen-Parameter für bestimmte Steuerungen ungültig, bzw. ab einer bestimmten Software-Version eingeführt oder entfernt wurden, sind zur Unterscheidung hinter der Parameter-Nummer Spalten mit Symbolen.

Bedeutung der Symbole

ω = Maschinen-Parameter ist bei dieser Steuerung für alle Software-Versionen gültig

04 = Maschinen-Parameter wurde erst ab einer bestimmten Software-Version (z.B. 04 bedeutet ab Software-Version 04) eingeführt.

I04 = Maschinen-Parameter ist ab einer bestimmten Software-Version (z.B. I04 bedeutet ab Software-Version 04) inaktiv bzw. durch einen anderen ersetzt worden.

\- = Maschinen-Parameter ist bei dieser Steuerung nicht vorhanden.

Anwender-Parameter

Mit der MOD-Funktion "Anwender-Parameter" kann auf bestimmte Maschinen-Parameter einfach zugegriffen werden, z.B. Anpassen der Daten-Schnittstelle. Die über diese MOD-Funktion zugänglichen Anwender-Parameter werden vom Werkzeugmaschinen-Hersteller über Maschinen-Parameter festgelegt.

Eingabewerte

Eingabewerte sind z.B.
.die Zahlen 0 oder 1 für die Auswahl von Funktionen, Vorzeichen oder Zählrichtung
bzw.
.Zahlenwerte für Vorschübe, Verfahrwege usw.

Daneben gibt es noch dezimale Eingabewerte, die sich aus der Kombination mehrerer Funktionen errechnen lassen.

Aufteilung

Die Maschinen-Parameter sind in Gruppen aufgeteilt.
Die Parameter-Nummern sind so aufgebaut, daß Erweiterungen der Liste problemlos möglich sind.

0-999	Meßsysteme und Maschinen-Achsen: Zuordnung, Auswertung, Korrekturen
1000	Positionierung
1400	Betrieb mit Geschwindigkeits-Vorsteuerung
1700	Betrieb mit Schleppabstand
2000	Nur für Funk-Erodier-Steuerung TNC 306
3000	Spindel-Steuerung
4000	Integrierte PLC
5000	Anpassung der Datenschnittstelle
6000	Messen mit 3D-Tastsystem
6200	Digitalisieren, nur wenn SW-Freigabemodul bestückt
7000	Sonstige
7100	Gewindebohren
7200	Anzeige und Programmierung
7330	Anwender-Parameter
7400	Bearbeitung und Programmlauf
7600	Hardware

Function		MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input		= TNC MP	355 Bit	AE-6 Input Value
Axes with encoder		10						0 =	without encoder	---------	-----	15
	X		0	◆	◆	◆	◆	+1 =	X-axis with encoder			
	Y		1	◆	◆	◆	◆	+2 =	Y-axis with encoder			
	Z		2	◆	◆	◆	◆	+4 =	Z-axis with encoder			
	IV		3	◆	◆	◆	◆	+8 =	IV. axis with encoder			
Encoder Monitoring:		30						0 =	without monitoring			
Absolute position with distance-	X		0	◆	◆	I04	◆	+1 =	X-axis monitored	---------	-----	15
coded reference marks	Y		1	◆	◆	I04	◆	+2 =	Y-axis monitored			
	Z		2	◆	◆	I04	◆	+4 =	Z-axis monitored			
	IV		3	◆	◆	I04	◆	+8 =	IV. axis monitored			
Encoder Signal		31						0 =	without monitoring	76		31
Amplitude	X		0	04	◆	◆	◆	+1 =	X-axis monitored		1	(15 TNC 2500)
	Y		1	04	◆	◆	◆	+2 =	Y-axis monitored		2	(15 TNC 306)
	Z		2	04	◆	◆	◆	+4 =	Z-axis monitored		3	
	IV		3	04	◆	◆	◆	+8 =	IV. axis monitored		4	
	S		4	-	◆	-	02	+16 =	S-axis monitored		5	
Encoder Signal		32						0 =	without monitoring	76		31
Frequency	X		0	04	◆	◆	◆	+1 =	X-axis monitored		1	(15 TNC 2500)
	Y		1	04	◆	◆	◆	+2 =	Y-axis monitored		2	(15 TNC 306)
	Z		2	04	◆	◆	◆	+4 =	Z-axis monitored		3	
	IV		3	04	◆	◆	◆	+8 =	IV. axis monitored		4	
	S		4	-	◆	-	02	+16 =	S-axis monitored		5	

Function		MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	= TNC MP	355 Bit	AE-6 Input Value
Screen display		40						0 = no display	--------	-----	15
	X		0	◆	◆	◆	◆	+1= X-axis displayed			
	Y		1	◆	◆	◆	◆	+2= Y-axis displayed			
	Z		2	◆	◆	◆	◆	+4= Z-axis displayed			
	IV		3	◆	◆	◆	◆	+8= IV. axis displayed			
Controlled axes		50						0 = no control	72		15
	X		0	◆	◆	◆	◆	+1= X-axis controlled		0	
	Y		1	◆	◆	◆	◆	+2= Y-axis controlled		1	
	Z		2	◆	◆	◆	◆	+4= Z-axis controlled		2	
	IV		3	◆	◆	◆	◆	+8= IV. axis controlled		3	
Auxiliary axes for the PLC		60						0 = no auxiliary axis	72		0
	X		0	-	09	◆	-	+1= X-axis is auxiliary axis		0	
	Y		1	-	09	◆	-	+2= Y-axis is auxiliary axis		1	
	Z		2	-	09	◆	-	+4= Z-axis is auxiliary axis		2	
	IV		3	-	09	◆	-	+8= IV. axis is auxiliary axis		3	
Allocation of the encoder inputs to the axes								0 to 5 TNC 306/360/2500 CNC 234/306 0 = X1 0 = X1 1 = X2 1 = X2 2 = X3 2 = X3 3 = X4 3 = X4 4 = no function 4 = X5 5 = X6[1] 5 = X6[1]			
	X	110.0	0	◆	◆	◆	◆		253		0
	Y	110.1	1	◆	◆	◆	◆		254		1
	Z	110.2	2	◆	◆	◆	◆		255		2
	IV	110.3	3	◆	◆	◆	◆		256		3
Allocation of the analog output (with common drive: several axes can be allocated to one output)								0 = output 1 0 to 5 1 = output 2 2 = output 3 3 = output 4 4 = output 5 5 = output S[2]	--------	-----	
	X	120.0		◆	◆	◆	◆				0
	Y	120.1		◆	◆	◆	◆				1
	Z	120.2		◆	◆	◆	◆				2
	IV	120.3		◆	◆	◆	◆				3

1) X6 may only be used for a machine tool axis, if no spindle orientation with TNC is required.
2) S-analog may only be used for a machine tool axis, if no analog output of spindle speed is required.

Function		MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input Value
Counting direction		210						0 = positive			
	X		0	◆	◆	◆	◆	+1 = X-axis negative	20	0	0
	Y		1	◆	◆	◆	◆	+2 = Y-axis negative	21	0	
	Z		2	◆	◆	◆	◆	+4 = Z-axis negative	22	0	
	IV		3	◆	◆	◆	◆	+8 = IV. axis negative	23	0	
Encoder evaluation	X	310.0		◆	◆	I04	◆	0 to 3	---------	------	0
	Y	310.1		◆	◆	I04	◆	0 = 256-fold			0
	Z	310.2		◆	◆	I04	◆	1 = 4-fold			0
	IV	310.3		◆	◆	I04	◆	2 = 2-fold			0
								3 = 1-fold			
Grating period								0 to 1000 [µm]	---------	------	
(Traverse range per grating period. consider	X	330.0		◆	◆	◆	◆	Decimal places are possible when			20
the screw pitch when using a rotary encoder)	Y	330.1		◆	◆	◆	◆	using rotary encoders. Due to internal			20
In case of square-wave input the traverse	Z	330.2		◆	◆	◆	◆	caluclations, these positions must be			20
range per square-wave period must be	IV	330.3		◆	◆	◆	◆	integral multiples of 0.125.			20
indicated (consider the external interpolation).											
External evaluation								0 to 5	---------	------	0
(to connect a distance-coded square-wave to	X	340.0		05	06	-	04	0 = no EXE			0
the encoder input)	Y	340.1		05	06	-	04	1 = 1-fold EXE			0
	Z	340.2		05	06	-	04	2 to 4 reserved			0
	IV	340.3		05	06	-	04	5 = 5-fold EXE			0
Line count of spindle encoder		340.4		-	16	-	08	0 = 1024 pulses			0
								2 = 2048 pulses			
								4 = 4096 pulses			
								1, 3, 5 reserved			
Axis designation	IV	410		-	-	07	-	0 = A 1 = B 2 = C	90		2
Axis designation	IV	410.3		◆	◆	I07	◆	0 = A 1= B 2 = C	90		2
								3 = U 4 = V 5 = W			
Axis correction	X	710.0		◆	◆	I04	◆	- 1.000 to + 1.000 [mm]	36		0
Backlash compensation	Y	710.1		◆	◆	I04	◆		37		0
	Z	710.2		◆	◆	I04	◆		38		0
	IV	710.3		◆	◆	I04	◆		39		0

Function		MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	= TNC MP	355 Bit	AE-6 Input Value
Compensation of reversal peak with circular movements											
- Magnitude of reversal peak	X	711.0		03	04	-	03	0 to 1 [mm]			0
	Y	711.1		03	04	-	03	(0 = inactive)	-	-	0
	Z	711.2		03	04	-	03				0
	IV	711.3		03	04	-	03				0
- Speed for compensation of reversal peak	X	712.0		03	04	-	03	0 to 10 [mm per CLP cycle time]	-	-	0
	Y	712.1		03	04	-	03	(0 = inactive)			0
	Z	712.2		03	04	-	03				0
	IV	712.3		03	04	-	03				0
Axis error compensation											
- Compensation factor for linear axis error compensation	X	720.0		◆	◆	◆	◆	- 1.000 to + 1.000 [mm/m]	40		0
	Y	720.1		◆	◆	◆	◆		41		0
	Z	720.2		◆	◆	◆	◆		42		0
	IV	720.3		◆	◆	◆	◆		43		0
- Multipoint axis error compensation		730						0 = inactive			0
	X		0	◆	◆	◆	◆	+1 = X axis active	20	2	
	Y		1	◆	◆	◆	◆	+2 = Y axis active	21	2	
	Z		2	◆	◆	◆	◆	+4 = Z axis active	22	2	
	IV		3	◆	◆	◆	◆	+8 = IV. axis active	23	2	
- Modulo value for reduction of secondary axes	X	810.0		-	10	-	-	0 to 99999.999 [mm]	-		0
	Y	810.1		-	10	-	-		-		0
	Z	810.2		-	10	-	-		-		0
	IV	810.3		-	10	-	-		-		0

Function		MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input value
software limit switch	X+	910.0		♦	♦	♦	♦	linear axis:	44		+ 30000
range 0	Y+	910.1		♦	♦	♦	♦	-30000.000 ... +30000.000 [mm]	46		"
basic setting after mains-on;	Z+	910.2		♦	♦	♦	♦	rotary axis:	48		"
activation via PLC:	IV+	910.3		♦	♦	♦	♦	-30000.000 ... +30000.000 [°]	50		"
M2817 = 0; M2816 = 0;	X-	920.0		♦	♦	♦	♦		45		- 30000
Strobe marker M2824	Y-	920.1		♦	♦	♦	♦		47		"
	Z-	920.2		♦	♦	♦	♦		49		"
	IV-	920.3		♦	♦	♦	♦		51		"
range 1	X+	911.0		♦	♦	♦	♦		363		+ 30000
activation via PLC:	Y+	911.1		♦	♦	♦	♦		365		"
M2817 = 0; M2816 = 1;	Z+	911.2		♦	♦	♦	♦		367		"
Strobe marker M2824	IV+	911.3		♦	♦	♦	♦		369		"
	X-	921.0		♦	♦	♦	♦		364		- 30000
	Y-	921.1		♦	♦	♦	♦		366		"
	Z-	921.2		♦	♦	♦	♦		368		"
	IV-	921.3		♦	♦	♦	♦		370		"

Function		MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input Value
Range 2	X+	912.0		◆	◆	◆	◆		371		+ 30000
Activation via PLC	Y+	912.1		◆	◆	◆	◆		373		+ 30000
M2817 = 1, M2816 = 0;	Z+	912.2		◆	◆	◆	◆		375		+ 30000
Strobe marker M2824	IV+	912.3		◆	◆	◆	◆		377		+ 30000
	X-	922.0		◆	◆	◆	◆		372		- 30000
	Y-	922.1		◆	◆	◆	◆		374		- 30000
	Z-	922.2		◆	◆	◆	◆		376		- 30000
	IV-	922.3		◆	◆	◆	◆		378		- 30000
Reference point for positioning blocks with M92: (referred to the ref. mark)	X	950.0		◆	◆	◆	◆	Linear axis:	186		0
	Y	950.1		◆	◆	◆	◆	-30 000.000 to +30 000.000 [mm]	187		0
	Z	950.2		◆	◆	◆	◆	Rotary axis:	189		0
	IV	950.3		◆	◆	◆	◆	-30 000.000 to +30 000.000 [°]	190		0
Shifting the reference point (machine datum)	X	960.0		-	-	04	-	-30 000.000 to +30 000.000 [mm]	-		0
	Y	960.1		-	-	04	-		-		0
	Z	960.2		-	-	04	-		-		0
	IV	960.3		-	-	04	-		-		0
Rapid traverse	X	1010.0		◆	◆	◆	◆	Linear axis:	0		10 000
	Y	1010.1		◆	◆	◆	◆	80 to 300 000 [mm/min]	1		10 000
	Z	1010.2		◆	◆	◆	◆	Rotary axis:	2		10 000
	IV	1010.3		◆	◆	◆	◆	800 to 300 000 [°/min]	3		10 000
Manual feed	X	1020.0		◆	◆	◆	◆	Linear axis:	4		10 000
	Y	1020.1		◆	◆	◆	◆	80 to 300 000 [mm/min]	5		10 000
	Z	1020.2		◆	◆	◆	◆	Rotary axis:	6		10 000
	IV	1020.3		◆	◆	◆	◆	800 to 300 000 [°/min]	7		10 000
Positioning window	X	1030.0		◆	◆	◆	◆	Linear axis:	58		0.025
	Y	1030.1		◆	◆	◆	◆	0.001 to 2.000 [mm]*	58		0.025
	Z	1030.2		◆	◆	◆	◆	Rotary axis:	58		0.025
	IV	1030.3		◆	◆	◆	◆	0.001 to 2.000 [°]*	192		0.025

* adapted to MP7290 (display step)

Function		MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input Value
Polarity of the nominal voltage		1040						0 = positive			
with positive traverse direction	X		0	◆	◆	◆	◆	+1 = X-axis negative	24		0
	Y		1	◆	◆	◆	◆	+2 = Y-axis negative	25		
	Z		2	◆	◆	◆	◆	+4 = Z-axis negatve	26		
	IV		3	◆	◆	◆	◆	+8 = IV. axis negative	27		
Analog voltage with		1050		I03	-	-	-	4.5 to 9 [V]	(52)		9
rapid traverse X, Y, Z, IV	X	1050.0		03	◆	◆	◆		52		9
	Y	1050.1		03	◆	◆	◆		300		9
	Z	1050.2		03	◆	◆	◆		301		9
	IV	1050.3		03	◆	◆	◆		302		9
Acceleration											
	X	1060.0		◆	◆	◆	◆	0.001 to 3.0 [m/s²] [1]	54		0.5
	Y	1060.1		◆	◆	◆	◆		297		0.5
	Z	1060.2		◆	◆	◆	◆		298		0.5
	IV	1060.3		◆	◆	◆	◆		299		0.5

[1] maximum input range of TNC 306 = 9.0 [m/s]²

Function	MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input Value
Radial acceleration	1070		◆	◆	◆	◆	0.001 to 3.0 [m/s²]	55		1
Integral factor X	1080.0		◆	◆	I04	◆	0 to 65 535	28		0
Y	1080.1		◆	◆	I04	◆		29		0
Z	1080.2		◆	◆	I04	◆		30		0
IV	1080.3		◆	◆	I04	◆		31		0
Positioning feed if no feed has been programmed (M37)	1090		-	-	◆	-	0 to 30 000 [mm/min]	------		1000
Feed during timing or short-circuit (M36)	1091		-	-	I04	-	0 to 30 000 [mm/min]	------		
Circular speed "Disk pocket cycle"										
Erosion (MOD 0,4)	1092		-	-	04	-	0 to 30 000 [rpm]	------		30
Erosion (MOD 1,5)	1094		-	-	04	-		------		30
Erosion (MOD 2,6)	1096		-	-	04	-		------		30
Free run (MOD 0,4)	1093		-	-	04	-		------		100
Free run (MOD 1,5)	1095		-	-	04	-		------		100
Free run (MOD 2,6)	1097		-	-	04	-		------		100
Standstill monitoring	1110		◆	◆	◆	◆	0.001 to 30 [mm] *	169		0.5
Movement monitoring	1140		◆	◆	◆	◆	0.03 to 10 [V]	234		1
Monitoring of the voltage jump	1141		-	-	◆	-	0.03 to 10.000 [V]	------		5

* adapted to MP7290 (display step)

Function		MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input Value
Waiting time before switching off the residual nom. value voltage, if the error message "Positioning Error" is displayed		1150		◆	◆	I04	◆	0 to 65.535 [s]	185		0
Automatic cyclic offset adjustment		1220		◆	◆	◆	◆	1 to 65 535 [s]	252		0
Reference mark approach								0 = positive			
Traverse direction for ref. mark approach	X	1320	0	◆	◆	◆	◆	+1 = X-axis negative	16		0
	Y		1	◆	◆	◆	◆	+2 = Y-axis negative	17		
	Z		2	◆	◆	◆	◆	+4 = Z-axis negative	18		
	IV		3	◆	◆	◆	◆	+8 = IV. axis negative	19		
Speed for ref. mark approach	X	1330.0		◆	◆	◆	◆	linear axis:	8		10 000
	Y	1330.1		◆	◆	◆	◆	80 to 30 000 [mm/min]	9		10 000
	Z	1330.2		◆	◆	◆	◆	rotary axis:	10		10 000
	IV	1330.3		◆	◆	◆	◆	80 to 30 000 [°/mm]	11		10 000
Speed when leaving the reference end position (only with rotary encoders MP1350 = 2)	X	1331.0		◆	◆	◆	◆	linear axis:	-------		500
	Y	1331.1		◆	◆	◆	◆	80 to 500 [mm/min]			500
	Z	1331.2		◆	◆	◆	◆	rotary axis:			500
	IV	1331.3		◆	◆	◆	◆	80 to 500 [°/min]			500
Axis sequence for ref. mark traverse								0 = no ref. mark traverse	59		
1. axis		1340.0		◆	◆	◆	◆	1 = X			1
2. axis		1340.1		◆	◆	◆	◆	2 = Y			2
3. axis		1340.2		◆	◆	◆	◆	3 = Z			3
4. axis		1340.3		◆	◆	◆	◆	4 = IV			4

Function		MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	AE-6 Input Value
Selecting the functional procedure when approaching the ref. marks	X	1350.0		◆	◆	◆	◆	0 = encoder with distance-coded ref. marks 1 = encoder without distance-coded ref. marks 2 = special operation (linear measurement via rotary encoders) 3 = encoder with distance-coded ref. marks	1
	Y	1350.1		◆	◆	◆	◆		1
	Z	1350.2		◆	◆	◆	◆		1
	IV	1350.3		◆	◆	◆	◆		1
Operation with feed precontrol or trailing operation		1390		◆	◆	-	◆	0 = precontrol 1 = trailing operation	0

Operation with Feed Precontrol

Function		MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	AE-6 Input Value
Position monitoring when operating with feed precontrol									
- erasable (POSITIONING ERROR)		1410		◆	◆	-	◆	0.001 to 30.000 [mm]*	0.5
- EMERGENCY STOP (GROSS POSITIONING ERROR A)		1420		◆	◆	-	◆		1
Kv factor for operation with feed precontrol	X	1510.0		◆	◆	-	◆	0.1 to 10	2
	Y	1510.1		◆	◆	-	◆		2
	Z	1510.2		◆	◆	-	◆		2
	IV	1510.3		◆	◆	-	◆		2
Approach speed		1520		◆	◆	-	◆	0.01 to 10 [m/min]	2
Transient behaviour during acceleration		1530		◆	◆	-	◆	0.01 to 0.999	0.25

* adapted to MP 7290 (display step)

Cams for "Reference End Position":
The reference marks can either be traversed manually using the axis directional keys or automatically with the start key. It is not necessary to enter a code number for the manual traverse as was the case with preceding TNC contouring controls. The traverse direction for the automatic traverse of the reference end marks is set in the MP1320. In order to invert the predetermined traverse direction, a cam for "reference end position" is required. The triggering signals for the "reference end position" are assigned to free PLC inputs. These PLC inputs are connected to the PLC markers M2506 and M2556 to M2559 via the PLC software.

Linear Encoder with Distance-Coded Reference Marks (MP1350.X = 0):
If the triggering signal "reference end position" is set when starting ref. mark traverse, the axis traverses in the direction opposite to that set in the MP1320. If the triggering signal "reference end position" is only set during automatic traverse, the TNC ignores this signal. Thus, there must be at least two reference marks within the range of the "reference end position". Reference mark evaluation takes place either in the range of the "reference end position" or else beyond this range. In case of an evaluation beyond the software limit switch range, the axis traverses automatically to the software limit switch after evaluation.

Linear Encoder without Distance-Coded Reference Marks (MP1350.X = 1):
The traverse direction is automatically reversed, if the axis traverses the cam for "reference end position" during automatic traverse. If the axis is already in the range of the "reference end position" when starting, the axis immediately traverses in the opposite direction. For this reason the reference mark my not be within the "reference end position" range.

Special Operation: Linear Measurement with a Rotary Encoder (MP1350.X = 2):
The axis traverses automatically to the cam for "reference end position" at the predetermined feed rate (MP1330). The axis is started at a reduced feed rate (MP1331) in the opposite direction; the first reference mark is evaluated after the end of the "reference end position" range has been reached. Then the axis is stopped. If the axis is already in the "ref. end position" range when starting, it traverses immediately with the reduced feed rate (MP1331) in the direction opposite to that indicated in MP1320.

Linear Encoder with Distance-Coded Reference Marks (MP1350.X = 3):
If the triggering signal "ref. end position" is set during reference mark traverse, the axis traverses opposite to the direction set in MP1320. The signal "reference end position" is not ignored by the TNC, if it is only set during automatic traverse. The traverse direction is reversed immediately. Thus, no reference marks are required in the "ref. end position" range.

Operation with Servo Lag

Function		MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	AE-6 Input Value
Position monitoring during		1710		◆	◆	-	◆	0 to 1000.000 [mm]	20
operation with servo lag	X	1710.0		-	-	◆	-		20
erasable (POSITIONING ERROR)	Y	1710.1		-	-	◆	-		20
	Z	1710.2		-	-	◆	-		20
	IV	1710.3		-	-	◆	-		20
EMERGENGY STOP		1720		◆	◆	-	◆	0 to 1000.000 [mm]	30
(GROSS POSITIONING	X	1720.0		-	-	◆	-		30
ERROR A)	Y	1720.1		-	-	◆	-		30
	Z	1720.2		-	-	◆	-		30
	IV	1720.3		-	-	◆	-		30
KV Factor	X	1810.0		◆	◆	◆	◆	0.1 to 10	2
for operation with servo lag	Y	1810.1		◆	◆	◆	◆		2
	Z	1810.2		◆	◆	◆	◆		2
	IV	1810.3		◆	◆	◆	◆		2
Multiplication factor for the KV factor		1820		◆	◆	-	◆	0.001 to 1.000	1
Characteristic kink		1830		◆	◆	-	◆	0 to 100.000 [%]	100
KV factor for eroding	X	1840.0		-	-	I04	-	0.1 to 10.000	1
	Y	1840.1		-	-	I04	-		1
	Z	1840.2		-	-	I04	-		1
	IV	1840.3		-	-	I04	-		1

Function	MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	AE-6 Input Value
Gradient of characteristic curve - negative feed - positive feed	2010.0 2010.1		- -	- -	◆ ◆	- -	0.1 to 60.000	0.5 0.75
Multiplication factor - for larger pos. gradient - for larger neg. gradient	2020.0 2020.1		- -	- -	◆ ◆	- -	1.000 to 60.000	2 2.5
Characteristic kink - for pos. feed - for neg. feed	2030.0 2030.1		- -	- -	◆ ◆	- -	0 to 100 %	60 40
Factor for gap size (1. current intensity)	2040		-	-	◆	-	0.1 to 60	1.5
Moving back the target position after: - repositioning due to M2671 (Cycl Stop) - repositioning due to M2621 (timer pulse)	2050 2051		- -	- -	04 04	- -	0 to 2.000 mm 0 to 2.000 mm	0.7 0.5
Start-up feed from free-run	2060		-	-	◆	-	1 to 500 mm/min	100
Feed rate at max. output voltage and with MP 2020 = 1.0	2070		-	-	◆	-	1 to 100 mm/min	50
Analog input (W 392)	2080		-	-	◆	-	0 = non-inverting 1 = inverting 2 = analog input of spindle pot for testing	0
Shaft speed for ROT-C, if D276 not loaded	2090		-	-	◆	-	1 to 100 [rpm]	100
Editing the last few spaces of the table (only INGERSOLL version)	2100		-	-	◆	-	0 = inhibited 1 = enabled	0

Function	MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	AE-6 Input Value
Sparking-out duration (minimum free-run duration)	2110		-	-	◆	-	0.1 to 99.9 [s]	1
Time for electric arc recognition	2120		-	-	◆	-	1 to 99.9 [s]	10
Max. speed for feed precontrol during gap control	2130		-	-	04	-	0 to 3000 [mm/min]	50
Max. permissble feed for eroding	2131		-	-	04	-	0 to 3000 [mm/min]	30
Free-run feed during eroding	2132		-	-	04	-	0 to 3000 [mm/min]	30
Retraction speed if a short circuit has occured (only during the eroding process) via X12	2133		-	-	04	-	0 to 3000 [mm/min]	200
Positioning during timing	2190		-	-	04	-	0 to 2 0 = During traverse of the timer distance the speed is reduced between the individual blocks 1 = The timer distance is traversed continuously, if the contour (line/circle) is geometrically continuous (recommended setting). 2 = The timer distance is traversed continuously, even if the contour is geometrically discontinuous. This causes an increased load on the driving elements in corners.	1
General eroding table	2199		-	-	◆	◆	0 = eroding table on 2 = eroding table off	2

Spindle Control

Function	MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input value
Outputting the spindle rpm	3010		♦	♦	–	♦	0 = no output of spindle rpms	62		7 (TNC 2500 = 5)
Coded			♦	♦	–	♦	1 = only if the rpm changes			
			♦	♦	–	♦	2 = with each tool call			
Analog			♦	♦	–	♦	3 = gear switching signal only if the gear stage changes			
			♦	♦	–	♦	4 = gear switching signal with each tool call			
			♦	♦	–	♦	5 = no gear switching signal			
Regulated spindle for orientation			I03	♦	–	♦	6 = gear switching signal only if gear stage changes	(237)		
			I03	♦	–	♦	7 = gear switching signal with each tool call			
			I03	♦	–	♦	8 = no gear switching signal			
Limiting the rpm code	3020		♦	♦	–	♦	0 ... 99999 01991 = no limitation	63		00991
Axis standstill if only one new spindle rpm is output with a TOOL CALL	3030		♦	♦	–	♦	0 = axis standstill 1 = no axis standstill	214	2	0
Displaying the spindle rpm	3110		I08	–	–	–	0 = displaying before M03 or M04 1 = displaying after M03 or M04	191		0
Programming the rpm S = 0 if MP 3240.1 unequal 0	3120		♦	♦	–	♦	0 => S = 0 permitted 1 => S = 0 not permitted	190		0

Function	MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input value
Polarity of S analog voltage	3130		♦	♦	-	♦	0 = M03: positive voltage M04: negative voltage 1 = M03: negative voltage M04: positive voltage 2 = M03 and M04: positive voltage 3 = M03 and M04: negative voltage	172		0
Counting direction/spindle	3140		-	♦	-	♦	0 = positive 1 = negative	239		0
Analog voltage for gear stages	3210.0	0	04	♦	-	♦	0 ... 9.999 [V]	86		9.999
	3210.1	1	04	♦	-	♦				"
	3210.2	2	04	♦	-	♦				"
	3210.3	3	04	♦	-	♦				"
	3210.4	4	04	♦	-	♦				"
	3210.5	5	04	♦	-	♦				"
	3210.6	6	04	♦	-	♦				"
	3210.7	7	04	♦	-	♦				"
Regulating range for S analog output										
Maximum output voltage for S analog output	3240.0		♦	♦	-	♦	0 ... 9.999 [V]	87		9.999
Minimum output voltage for S analog output	3240.1		♦	♦	-	♦	0 ... 9.999 [V]	184		0
Nominal value voltage for spindle drive during gear switching (rotary direction w. markers 2490 a. 2491)	3240.2		♦	♦	-	♦	0 ... 9.999 [V]	70		2
Analog voltage with 100% S override	3240.3		I04	–	–	–	0 ... 9.999 [V]	86		9.999

Function		MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input value
Limitating the S-override	Maximum	3310.0		♦	♦	–	♦	0 ... 150 [%]	88		150
	Minimum	3310.1		♦	♦	–	♦		89		0
Ramp gradient for S analog											
for **spindle on/off**, M03, M04, M05		3410.0		♦	♦	–	♦	0 ... 1.999 [V/ms]	168		0.1
for **spindle orientation**		3410.1		♦	♦	–	♦	0 ... 1.999 [V/ms]	(316)		0.1
for the **"tapping" cycle**		3410.2			♦	–	03	0 ... 1.999 [V/ms]	(317)		0.1
for the **"rigid tapping" cycle**		3410.3			03	–	03	0 ... 1.999 [V/ms]	(318)		0.1
(compared with the acceleration ramp of the tool axis; the flatter ramp is the decisive value)											
Positioning window for spindle		3420		I03	♦	–	♦	0 ... 65535 incrementals	246		10
Spindle preset		3430		I03	♦	–	♦	0 ... 360 [°]	240		0
Kv factor for spindle	0	3440.0		I03	♦	–	♦	0.1 ... 10	238		2
per gear stage	1	3440.1		I03	♦	–	♦				2
	2	3440.2		I03	♦	–	♦				2
	3	3440.3		I03	♦	–	♦				2
	4	3440.4		I03	♦	–	♦				2
	5	3440.5		I03	♦	–	♦				2
	6	3440.6		I03	♦	–	♦				2
	7	3440.7		I03	♦	–	♦				2
S analog output	0	3510.0		♦	♦	–	♦	0 ... 99999.999 [rpm]	78		1000
Rpm range for	1	3510.1		♦	♦	–	♦		79		2000
gear stages	2	3510.2		♦	♦	–	♦		80		3000
	3	3510.3		♦	♦	–	♦		81		4000
	4	3510.4		♦	♦	–	♦		82		5000
	5	3510.5		♦	♦	–	♦		83		6000
	6	3510.6		♦	♦	–	♦		84		7000
	7	3510.7		♦	♦	–	♦		85		8000

Function	MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input value
Spindle rpm if marker 2501 is set	3520.0		♦	♦	-	♦	0 ... 99999.999 [rpm] The rot. direc. is always positive	258		0
Spindle rpm for spindle orientation	3520.1		I03	♦	-	♦	0 ... 99999.999 [rpm]	248		10

Integrated PLC

Function		MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input value
PLC program on RAM or from EPROM		4010		♦	♦	♦	♦	+ 0 = EPROM operation + 1 = RAM operation	77		0
PLC utilization with 100%		4020		I03	–	–	–	PLC run time [ms]			
Automatic lubrification	X	4060.0		♦	♦	♦	♦	0 ... 65535	159		1000
	Y	4060.1		♦	♦	♦	♦	(in units of 65536 µm)	160		1000
	Z	4060.2		♦	♦	♦	♦		161		1000
	IV	4060.3		♦	♦	♦	♦		162		1000
PLC: timer time for timers 0 - 47		4110.0		♦	♦	♦	♦	0 ... 65535 in units of 24 ms	110		100
		4110.1		♦	♦	♦	♦		111		22
		4110.2		♦	♦	♦	♦		112		50
		4110.3		♦	♦	♦	♦		113		100
		4110.4		♦	♦	♦	♦		114		4
		4110.5		♦	♦	♦	♦		115		5
		4110.6		♦	♦	♦	♦		116		6
		4110.7		♦	♦	♦	♦		117		7
		4110.8		♦	♦	♦	♦		118		8

Function	MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input value
	4110.9		♦	♦	♦	♦		119		9
	4110.10		♦	♦	♦	♦		120		10
	4110.11		♦	♦	♦	♦		121		11
	4110.12		♦	♦	♦	♦		122		12
	4110.13		♦	♦	♦	♦		123		13
	4110.14		♦	♦	♦	♦		124		14
	4110.15		♦	♦	♦	♦		125		15
	4110.16		♦	♦	♦	♦		193		25
	4110.17		♦	♦	♦	♦		194		0
	4110.18		♦	♦	♦	♦		195		0
	4110.19		♦	♦	♦	♦		196		0
	4110.20		♦	♦	♦	♦		197		0
	4110.21		♦	♦	♦	♦		198		0
	4110.22		♦	♦	♦	♦		199		0
	4110.23		♦	♦	♦	♦		200		0
	4110.24		♦	♦	♦	♦		201		0
	4110.25		♦	♦	♦	♦		202		0
	4110.26		♦	♦	♦	♦		203		0
	4110.27		♦	♦	♦	♦		204		0
	4110.28		♦	♦	♦	♦		205		0
	4110.29		♦	♦	♦	♦		206		0
	4110.30		♦	♦	♦	♦		207		0
	4110.31		♦	♦	♦	♦		208		0
	4110.32		♦	♦	♦	♦		264		0
	4110.33		♦	♦	♦	♦		265		0
	4110.34		♦	♦	♦	♦		266		0
	4110.35		♦	♦	♦	♦		267		0
	4110.36		♦	♦	♦	♦		268		0
	4110.37		♦	♦	♦	♦		269		0
	4110.38		♦	♦	♦	♦		270		0
	4110.39		♦	♦	♦	♦		271		0
	4110.40		♦	♦	♦	♦		272		0
	4110.41		♦	♦	♦	♦		273		0

Function	MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input value
	4110.42		♦	♦	♦	♦		274		0
	4110.43		♦	♦	♦	♦		275		0
	4110.44		♦	♦	♦	♦		276		0
	4110.45		♦	♦	♦	♦		277		0
	4110.46		♦	♦	♦	♦		278		0
	4110.47		♦	♦	♦	♦		279		0
PLC: counter preset value for counters 0 - 31	4120.0		♦	♦	♦	♦	0 ... 65535	94		0
	4120.1		♦	♦	♦	♦	in units of 24 ms	95		1
	4120.2		♦	♦	♦	♦		96		2
	4120.3		♦	♦	♦	♦		97		3
	4120.4		♦	♦	♦	♦		98		4
	4120.5		♦	♦	♦	♦		99		5
	4120.6		♦	♦	♦	♦		100		6
	4120.7		♦	♦	♦	♦		101		7
	4120.8		♦	♦	♦	♦		102		8
	4120.9		♦	♦	♦	♦		103		9
	4120.10		♦	♦	♦	♦		104		10
	4120.11		♦	♦	♦	♦		105		11
	4120.12		♦	♦	♦	♦		106		12
	4120.13		♦	♦	♦	♦		107		13
	4120.14		♦	♦	♦	♦		108		14
	4120.15		♦	♦	♦	♦		109		15
	4120.16		♦	♦	♦	♦		280		16
	4120.17		♦	♦	♦	♦		281		17
	4120.18		♦	♦	♦	♦		282		18
	4120.19		♦	♦	♦	♦		283		19
	4120.20		♦	♦	♦	♦		284		20
	4120.21		♦	♦	♦	♦		285		21
	4120.22		♦	♦	♦	♦		286		22
	4120.23		♦	♦	♦	♦		287		23
	4120.24		♦	♦	♦	♦		288		24
	4120.25		♦	♦	♦	♦		289		25

Function	MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input value
	4120.26		♦	♦	♦	♦		290		26
	4120.27		♦	♦	♦	♦		291		27
	4120.28		♦	♦	♦	♦		292		28
	4120.29		♦	♦	♦	♦		293		29
	4120.30		♦	♦	♦	♦		294		30
	4120.31		♦	♦	♦	♦		295		31
Fast PLC input Definition of the fast input	4130		05	06	-	04	0 ... 254	---------		0
Definition of the active level of the fast input	4131		05	06	-	04	0 = 0V active 1 = 24V active	---------		0

Function	MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input value
PLC: 36 positioning values	4210.0		♦	♦	♦	♦	-30000.000...+30000.000[mm]	126		+10
for PLC positioning	4210.1		♦	♦	♦	♦		127		+1
	4210.2		♦	♦	♦	♦		128		+2
12 positioning values	4210.3		♦	♦	♦	♦		129		+3
for PLC positioning or	4210.4		♦	♦	♦	♦		130		+4
datum shift	4210.5		♦	♦	♦	♦		131		+5
	4210.6		♦	♦	♦	♦		132		+6
	4210.7		♦	♦	♦	♦		133		+7
	4210.8		♦	♦	♦	♦		134		+8
	4210.9		♦	♦	♦	♦		135		+9
	4210.10		♦	♦	♦	♦		136		+10
	4210.11		♦	♦	♦	♦		137		+11
	4210.12		♦	♦	♦	♦		138		+12
	4210.13		♦	♦	♦	♦		139		+13
	4210.14		♦	♦	♦	♦		140		+14
	4210.15		♦	♦	♦	♦		141		+15
	4210.16		♦	♦	♦	♦		142		+16
	4210.17		♦	♦	♦	♦		143		+17
	4210.18		♦	♦	♦	♦		144		+18
	4210.19		♦	♦	♦	♦		145		+19
	4210.20		♦	♦	♦	♦		146		+20
	4210.21		♦	♦	♦	♦		147		+21
	4210.22		♦	♦	♦	♦		148		+22
	4210.23		♦	♦	♦	♦		149		+23
	4210.24		♦	♦	♦	♦		150		+24
	4210.25		♦	♦	♦	♦		151		+25
	4210.26		♦	♦	♦	♦		152		+26

Function	MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	AE-6 Input Value
	4210.27		◆	◆	◆	◆		+27
	4210.28		◆	◆	◆	◆		+28
	4210.29		◆	◆	◆	◆		+29
	4210.30		◆	◆	◆	◆		+30
	4210.31		◆	◆	◆	◆		+31
4 values for datum shift or	4210.32		◆	◆	◆	◆		+0
PLC positioning	4210.33		◆	◆	◆	◆		+0
	4210.34		◆	◆	◆	◆		+0
	4210.35		◆	◆	◆	◆		+0
Position value for PLC positioning	4210.36		◆	◆	◆	◆		+0
4 values for datum shift or	4210.37		◆	◆	◆	◆		+0
PLC positioning	4210.38		◆	◆	◆	◆		+0
	4210.39		◆	◆	◆	◆		+0
	4210.40		◆	◆	◆	◆		+0
Position value for PLC positioning	4210.41		◆	◆	◆	◆		+0
4 values for datum shift or	4210.42		◆	◆	◆	◆		+0
PLC positioning	4210.43		◆	◆	◆	◆		+0
	4210.44		◆	◆	◆	◆		+0
	4210.45		◆	◆	◆	◆		+0
Position values for PLC positioning	4210.46		◆	◆	◆	◆		+0
	4210.47		◆	◆	◆	◆		+0
Setting a number in the PLC								
W 960	X 4220.0		◆	◆	◆	◆	0 to 65535	5000
W 962	Y 4220.1		◆	◆	◆	◆		5000
W 964	Z 4220.2		◆	◆	◆	◆	e.g. feed rate for PLC positioning	5000
W 966	IV 4220.3		◆	◆	◆	◆		5000
PLC user parameters	4220.4		-	-	04	-		-
	4220.5		-	-	04	-		-
	4220.6		-	-	04	-		-
	4220.7		-	-	04	-		-

Function	MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input Value
Comparison values and axis-specific displacement values for temperature compensation Nom. position values for PLC positioning (positioning module)	4230.0 . . . 4239.0	... 31 ... 31	-	04	-	04	linear axis: -30 000 000 to +30 000 000 [mm] rotary axis: -30 000 000 to +30 000 000 [mm]	------ ------		0 0
Setting the PLC markers										
2192 to 2207	4310.0		◆	◆	◆	◆	0 to 65 535	158		20480
2208 to 2223	4310.1		◆	◆	◆	◆		249		0
2224 to 2239	4310.2		◆	◆	◆	◆		250		0
3200 to 3215	4310.3		◆	◆	◆	◆		209		0
3216 to 3231	4310.4		◆	◆	◆	◆		210		0
3232 to 3247	4310.5		◆	◆	◆	◆		211		0
3248 to 3263	4310.6		◆	◆	◆	◆		212		0
PLC user parameters	4310.7	... 15	-	-	04	-		------		0
PLC user parameters	4310.7	... 15	-	-	04	-		------		0

Adapting the Data Interface

Function	MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input Value
Control character "end of text" (ETX)	5010		-	-	04	-	0 to 255			3
1. control character "end of text" (ETX) 2. control character "beginning of text" (STX)	5010.0*		◆	◆	-	◆	0 to 32382	71		515
1. ASCII character for file type (data input) 2. ASCII character for input code (E)	5010.1*		◆	◆	-	◆	0 to 32382	218		17736
1. ASCII character for file type (data output) 2. ASCII character for output code (A)	5010.2*		◆	◆	-	◆	0 to 32382	219		16712
1. control character "end command block" (ETB) 2. control character "start command block" (SOH)	5010.3*		◆	◆	-	◆	0 to 32382	220		279
1. control character for positive acknowledge (ACK) 2. control character negative acknowledge (NAK)	5010.4*		◆	◆	-	◆	0 to 32382	221		0
Control character for end of transfer (EOT)	5010.5*		◆	◆	-	◆	0 to 32382	224		0
Control character for end of transfer (EOT)	5011		-	-	04	-	0 to 32382	----		4

* accessible via code number 123

Function	MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input Value
Data format and transfer stop for the external data interface RS232/EXT	5020*		◆	◆	◆	◆	0 to 255	222		168
7 or 8 data bits		0					+ 0 = 7 data bits, bit 8: parity bit + 1 = 8 data bits, bit 8 = 0, bit 9: parity bit			
Block check character		1					+ 0 = BCC character is also control character + 2 = BCC character is not control character			
Transfer stop by RTS		2					+ 0 = inactive + 4 = active			
Transfer stop by DC3		3					+ 0 = inactive + 8 = active			
Character parity even/odd		4					+ 0 = even + 16 = odd			
Character parity on/off		5					+ 0 = off + 32 = on			
Number of stop bits		6/7					+ 64 = bit 6 = 1 + 128 = bit 7 = 1 7 | 6 0 | 0 = 1 1/2 stop bits 0 | 1 = 2 stop bits 1 | 0 = 1 stop bit 1 | 1 = 1 stop bit			
Activating the RTS signal		8	-	16	-	08	+ 0 = RTS signal permanently active + 256 = RTS signal is activated together with data transfer and deactivated when transfer is finished.			

*accessible via code number 123

Function	MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input Value
Operating mode EXT	5030*		◆	◆	-	◆	0 = "standard data interface" 1 = "blockwise transfer"	223		0
Transfer speed for PLC coupling	5040		- - - - - - - - - -	03 03 03 03 03 03 03 03 03 03	- - - - - - - - - -	- - - - - - - - - -	0 = 110 [bd] 1 = 150 2 = 300 3 = 600 4 = 1200 5 = 2400 6 = 4800 7 = 9600 8 = 19200 9 = 38400	------		7
Graphic printout	5110.0 5110.1 5110.2 5110.3		I04	-	-	-	0 = no function	226 227 228 229		0
Graphic printout	5120.0 5120.1 5120.2 5120.3		I04	-	-	-	0 = no function	230 231 232 233		0
Block number check when downloading via the interface	5990		-	-	◆	-	0 = NC program with block numbers 1 = NC program without block numbers	------		0

Measuring with 3D Touch Probe

Function	MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	AE-6 Input Value
Touch probe selection	6010*		◆	◆	I04	◆	0 = cable transmission 1 = infrared transmission	0
Number of probing operations	6100		-	-	10	-	0, 1 = one probing operations 2 - 5 = number of probing operations	0
Maximum difference between several probing operations (message: PROBE VALUE INACCURATE)	6110		-	-	11	-	0 to 2 mm	0
Touch probe: feed for probing	6120*		◆	◆	◆	◆	80 to 30 000 [mm/min]	1000
Touch probe: measuring range	6130*		◆	◆	◆	◆	0.001 to 30 000.000 [mm]	20
Touch probe: set-up clearance above the measuring point for automatic measurement	6140*		◆	◆	I02	◆	0.001 to 30 000.000 [mm]	20
Limitation of retraction for MANUAL PROBING	6140*		-	-	11	-	0 to 19 999.999 [mm] 0 = stylus always retracted to starting pos.	0
Touch probe: Rapid traverse for probing	6150*		◆	◆	◆	◆	80 to 30 000 [mm/min]	2000

Digitizing with 3D Touch Probe

Function	MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	AE-6 Input Value
Oscillations in normal direction	6210**		-	03	-	03	0 to 65535 [s]	3
Feed in normal direction	6230**		-	03	-	03	0 to 1000 [mm/min]	30
Rated break point of stylus	6240**		-	03	-	03	0 to 10 [mm]	5
Modal M86	6250**		-	03	-	03	0 to 89	33
Output M90	6260**		-	03	-	03	0 = no 1 = yes	0
Output values rounded	6270**		-	03	-	03	0 = 1 µm 1 = 10 µm	0

* accessible via code number 123 ** only if software enable module inserted

Others

Function	MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input value
Automatic acknowledgement of the error message "power interrupted"	7000		--	03	--	03	0 = error message "power interrupted" must be acknowledged manually 1 = error message "power interrupted" is automatically acknowledged after approx. 3 seconds	92	11	0

Tapping

Function	MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input value
Minimum for feed override	7110.0		♦	♦	-	♦	0 ... 150 [%]	182		95
Maximum for feed override	7110.1		♦	♦	-	♦	0 ... 150 [%]	183		105
Dwell time for spindle rotation reverse in the tapping cycle	7120.0		♦	♦	-	♦	0 ... 65.535 [s]	67		0
Preswitch-off time of the spindle for the tapping cycle (active only with BCD output of the spindle rpm)	7120.1		♦	♦	-	♦	0 ... 65.535 [s]	73		0
Spindle lag time after reaching the boring depth (active with S analog only)	7120.2		♦	03	-	03	0 ... 65.535 [s]	73		0
Run-in behaviour of the spindle in the "rigid tapping" cycle	7130		-	03	-	03	0.1 ... 10 [m/min]	--		2
Transient behaviour of the spindle when accelerating in the "rigid tapping" cycle	7140		-	03	-	03	0.01 ... 0.9999	--		0.25
Positioning window for the thread	7150		-	03	-	03	0.01 ... 2.0 [µm]	--		0.05

Function	MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	AE-6 Input Value
Spindle orientation at the beginning of cycle 17 "Rigid Tapping"	7160		07	09	-	06	0 = orientation active 1 = orientation inactive	0
Programming station	7210*		◆	◆	◆	◆	0 = control 1 = progr.station: PLC active 2 = progr. station: PLC inactive	0
Multiple function for straight cut control (TNC 335)	7215						0, 1, 3	0
Path interpolation suppressed		0	-	04	-	-	+0 = not suppressed (= TNC 360) +1 = suppressed (= TNC 335)	
Actual value display selectable with MOD		1	-	07	-	-	+0 = selection with MOD enabled +2 = selection with MOD disabled (only if bit 0 = 1)	
Block number step size (for ISO programming)	7220*		04	◆	-	◆	0 to 255	1
HEIDENHAIN conversational programming / ISO programming	7222		07	◆	-	◆	0 = HEIDENHAIN and ISO 1 = HEIDENHAIN 2 = ISO	0
Automatic generation of NC blocks in the PROGRAMMING mode	7225	0	-	10	-	-	+1 = create block with key "Actual Position Capture"	0
		1					+2 = create block with PLC marker M2829	
Switching over the dialog language	7230		◆	◆	◆	◆	0 = 1. language 1 = 2. language	0
LOGO after power-on	7231		-	-	09	-	0 = standard logo 1 to 99 = dialog from PLC EPROM	0

* accessible via code number 123

Function	MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input value
reset of the software clocks that can be called with SZ 85 72 82	7235	0	05	06			+0 = no reset +1 = reset of control delay time	---------		0
		1	05	06			+0 = no reset +2 = reset of program operating delay time			
		2	05	06			+0 = no reset +4 = reset delay time spindle			
inhibiting the program input with program no. = manufacturer cycle no.	7240*		♦	♦	♦	♦	0 = inhibited 1 = not inhibited	---------		1
inhibiting the HEIDENHAIN cycles 0 ... 15 cycles 16 ... 31	7245.0 7245.1		♦ ♦	♦ ♦	♦ ♦	♦ ♦	0 ... 65535 0 = no cycle inhibited	---------		0
difference between Q parameter numbers for the "DLG-DEF"-block and "DLG-Call"-block in the user cycle	7250		♦	♦	♦	♦	0 ... 50 0 if "DLG-CALL"-blocks only	263		0
number of global Q parameters which are transmitted from a manufacturer cycle to the calling program.	7251		♦	♦	♦	♦	0 ... 100 When entering 40 the Q parameters Q60...Q90 are global	262		0
central tool memory	7260*		♦	♦	♦	♦	0 = no central tool memory 1 ... 99 = central tool memory input value = number of tools	225		0
number of tools with pocket number	7261*		♦	♦	-	♦	0 ... 254	(209)		10
number of reserved pockets next to the special tool	7264*		♦	♦	-	♦	0 ... 3	--------		0

* accessible via code number 123

Function	MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input Value
Display of the current feed rate before start in the manual operating modes (same feed rate in all axes, i.e. smallest feed programmed)	7270*		◆	◆	I13	◆	0 = display inhibited 1 = display active	167		1
Display of free-run, short-circuit, positioning feed, eroding feed	7271		-	-	02	-	0 = display inhibited 1 = display active	-		0
Display of the current machining time	7272		-	-	◆	-	0 = display active 1 = display inhibited	-		0
Display of the (current) NC blocks and the Q-parameters in the TEST mode	7273		-	-	04	-	0 = display active 1 = display inhibited	-		1
Display of the current gear stage after the character "/" in the status line	7274	0	-	04	-	04	+0 = display inhibited +1 = display active	-		0
Determination of the spindle performance		1	05	06	-	04	+0 = via analog output Caution: max. value 4.999V +2 = via PLC word W660	-		0
Display mode for rotary axis (if MP 7470 = 0)	7274		-	-	07	-	0 = 0 to 359.999° 1 = -180.000° to +179.999°	-		0
Reference value 100% for display of spindle performance	7275		04	06	-	04	7274 bit 1 = 0 : 0 to 4.999 [V] 7274 bit 1 = 1 : 0 to 43960	-		0
Decimal sign	7280*		◆	◆	◆	◆	0 = decimal comma 1 = decimal point	92	0	0
Tool length in nom./actl. value display	7285*		03	04	-	04	0 = tool length ignored 1 = tool length taken into account	-		0

* accessible via code number 123

Function	MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	AE-6 Input Value
Display step	7290*		◆	I07	-	I04	0 = 1 µm[2] 1 = 5 µm[2]	
			07	07	-	04	0 = 1 µm	0
			07	07	-	04	1 = 5 µm	
			07	07	-	04	2 = 10 µm	
			07	07	-	04	1 = 50 µm	
			07	07	-	04	2 = 100 µm	
Selective erasing of - status data (S) - TOOL data (T) - Q-parameter contents with M02, M30	7300*		I07	I07	◆	I02	0 = status display and Q-parameters erased 1 = status display and Q-parameters not erased 0 to 7[1] - = data are erased	0
		0	07	07	-	02		
		1						
		2						

	program end	program selection
0 =	S Q T	- - -
1 =	- - -	- - -
2 =	S Q T	- Q -
3 =	- Q -	- Q -
4 =	S Q T	- - T
5 =	- - T	- - T
6 =	S Q T	- Q T
7 =	- Q T	- Q T

GOTO block after CYCLE CALL	7305		-	-	11	-	0 = permitted 1 = not permitted	0
Graphics (display mode) changeover of 3-plane display	7310*	0	◆	◆	◆	◆	+0 = German standard +1 = American standard	0
Rotation of the coordinate system in the machining plane by 90°		1					+0 = no rotation +2 = coordinate system rotated by 90°	

* accessible via code number 123

1) With entry values ≥4 the (programmed) tool inserted last is automatically activated with power-on.

2) The input range of TNC 2500B/C has been expanded.

User Parameters

Function		MP No.	Bit	TNC 2500	TNC 360	XNC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input value
Determining the user parameters which can be called via the MOD-function	0	7330.0		♦	♦	♦	♦	0 ... 9999.99 number of the machine parameter required	----------		0
	1	7330.1		♦	♦	♦	♦		----------		0
	2	7330.2		♦	♦	♦	♦		----------		0
	3	7330.3		♦	♦	♦	♦		----------		0
	4	7330.4		♦	♦	♦	♦		----------		0
	5	7330.5		♦	♦	♦	♦		----------		0
	6	7330.6		♦	♦	♦	♦		----------		0
	7	7330.7		♦	♦	♦	♦		----------		0
	8	7330.8		♦	♦	♦	♦		----------		0
	9	7330.9		♦	♦	♦	♦		----------		0
	10	7330.10		♦	♦	♦	♦		----------		0
	11	7330.11		♦	♦	♦	♦		----------		0
	12	7330.12		♦	♦	♦	♦		----------		0
	13	7330.13		♦	♦	♦	♦		----------		0
	14	7330.14		♦	♦	♦	♦		----------		0
	15	7330.15		♦	♦	♦	♦		----------		0
Determining the user parameters which can be called via the MOD-function	0	7340.0			03	-	03	0..99 dia. from the PLC error range 0...199 dialog from the PLC dialog range	----------		199
	1	7340.1			03	-	03		----------		198
	2	7340.2			03	-	03		----------		197
	3	7340.3			03	-	03		----------		196
	4	7340.4			03	-	03		----------		195
	5	7340.5			03	-	03		----------		194
	6	7340.6			03	-	03		----------		193
	7	7340.7			03	-	03		----------		192
	8	7340.8			03	-	03		----------		191
	9	7340.9			03	-	03		----------		190
	10	7340.10			03	-	03		----------		189
	11	7340.11			03	-	03		----------		188
	12	7340.12			03	-	03		----------		187
	13	7340.13			03	-	03		----------		186
	14	7340.14			03	-	03		----------		185
	15	7340.15			03	-	03		----------		184

Processing and Program Run

Function	MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	AE-6 Input Value
Cycle "Scaling Factor" active on 2 or 3 axes	7410*		◆	◆	◆	◆	0 = 3 axes 1 = in the operating plane	0
Cycle 7 "Datum"	7411		-	-	04	-	0 = values from the datum table for the C-axis are treated as rotation and displacement values 1 = values from the datum table for the C-axis are only treated as displacement values	0
Tool data in a TOUCH PROBE block	7411		07	10	-	-	0 = the current tool data are overwritten by the calibrated touch probe data 1 = the current tool data are stored	1
Function of a CYCL CALL after a CYCLE DEF	7412		-	-	11	-	0= with CYCL CALL a PGM xxxx is called like an OEM cycle, i.e. the blocks of the program do not appear, and local Q-parameters are stored. 1 = the CYCL CALL acts like a PGM CALL xxxx, but with the M functions M89/M99 being active.	0

* accessible via code number 123

Function	MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	= TNC 355 MP	Bit	AE-6 Input Value
Cycle for milling pockets of any contour	7420*				-			241		0
Clear out cycle: direction for pilot milling of the contour		0	◆	◆		◆	+0 = pilot milling of the contour: ccw with pockets cw with islands +1 = cw with pockets ccw with islands			
Clear out cycle: sequence for clearing out and pilot milling		1	◆	◆		◆	+0 = mill a channel round the contour first, then clear out pocket +2 = clear out pocket first, then mill a channel round the contour			
Combining compensated or non-compensated contours		2	◆	◆		◆	+0 = combine compensated contours +4 = combine non-compensated contours			
Clearing out / pilot milling until the pocket depth is reached or for every infeed movement		3	04	◆		◆	+0 = clearing out / pilot milling for all infeed movements +8 = with every infeed, "Pilot milling" is run before "Clearing out" (depending on bit 1)			

* accessible via code number 123

Function	MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	AE-6 Input Value
Overlapping factor for pocket milling	7430*		◆	◆	-	◆	0, 1	1.3
Output of M-functions Programmed stop at M06	7440*	0	◆	◆	◆	◆	+ 0 = programmed stop at M06 + 1 = no programmed stop at M06	0
Output of M89, modal cycle call		1	◆	◆	◆	◆	+ 0 = no cycle call; standard output of M89 at the beginning of a block + 2 = modal cycle call at end of block	
Axis standstill during output of an M-function Exceptions: axis standstill always occurs with M-functions that result in a programmed stop (e.g. M00, M02 ...) or with a STOP or a CYCLE CALL.		2	◆	◆	◆	◆	+ 0 = axis standstill + 4 = no axis standstill	
no function		3	-	-	-	-	-	
no function		4	-	-	-	-	-	
Setting PLC markers M2008 - M2011 during time-outs between two NC blocks or during internal processing times (parameter calc.)		5	10	16	-	07	+0 = function not active +32 = function active	
Constant contour speed in corners	7460*		◆	◆	◆	◆	0 to 179.000 [°]	10
Display mode and software limit switches for rotary axis	7470*		04**	I07	I02	I04	0 = 0 to ± 359.999° (software limit switches not monitored) 1 = 0 to ± 30 000.000° (software limit switches monitored)	0
Range of traverse for rotary axis			-	07	-	-	0 = 0 to 359.999° (limit switches inactive) 1 = ± 360.000° (limit switches active)	

* accessible via code number 123
** only possible with TNC 2500

Function	MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	AE-6 Input Value
Display mode and software limit switches for rotary axis Approaching the target position	7470*	0 1	06**	07	-	04	+0 = 0 to ± 359.999° (no software limit switch monitor) +1 = 0 to ± 30000.000° (software limit switch monitor active) +0 inactive +2 = - absolute programmed movements are always traversed following the shortest path - incremental programmed movements by the increment	0
Output of tool number	7480		-	-	◆	-	0 = not output to PLC 1 = output of tool number only if tool number changes 2 = tool number is always output	0
Output of tool number or pocket number with TOOL CALL blocks	7480.0		◆	◆	-	◆	0 = no output 1 = output of tool number only if tool number changes 2 = output of tool number with every TOOL CALL 3 = output of pocket number (only if MP7260 > 0)	2
Output of tool number or pocket number with TOOL DEF blocks (only if MP 7260 >0)	7480.1		◆	◆	-	◆	0 = no output 1 = output of tool number only if tool number changes 2 = output of tool number with every TOOL DEF 3 = output of pocket number	0

*accessible via code number 123 ** only TNC 2500 B/C

Function	MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	AE-6 Input Value
Output of the last TOOL CALL of a block scan (in the TEST mode and before reapproaching a contour with positioning logic)	7481		-	-	08	-	0 = no output to PLC 1 = output to PLC	0
Output of M-functions in the TEST mode to the PLC	7490		-	-	08	-	0 = no output to PLC 1 = output to PLC	0
Limit switch check in the TEST mode	7491		-	-	08	-	0 = limit switches active 1 = limit switches not active	0

Function	MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	AE-6 Input Value
Feed rate and spindle override	7620*							
- Feed rate override if rapid traverse button is pressed in "Program Run"		0	◆	◆	◆	◆	+ 0 = override inactive + 1 = override active	8
- Feed rate override in 2% or 1% increments (if inactive always 1%)		1	I06	I09	◆	I06	+ 0 = 2% increments + 2 = 1% increments	
-Feed rate override if rapid traverse button and machine direction buttons are pressed in "Manual" operating mode		2	◆	◆	◆	◆	+ 0 = override inactive + 4 = override active	
- Override in 0.01% increments with a non-linear characterisic curve (see enhanc. 432, sec. 19.4)		3	06	09	-	06	+ 0 = override inactive + 8 = 0.01% increments	
Handwheel	7640*		I03	I04	-	I04	0 = machine with electronic handwheel 1 = machine without electronic handwheel	0
Adaptation							0 = no handwheel connected	
			03	04	-	04	1 = HR 330 (all keys via NC)[1] 2 = HR 130, HR 330 (all keys via NC)[2] 3 = HR 330 "Rapid" key: PLC I 162 "Plus" key: PLC I 160 "Minus" key: PLC I 161 4 = HR 332, evaluation of keys and LEDs depends on MP7645.0 5 = HRA 110, multi-axis handwheel (3x HR150)	1

* accessible via code number 123

[1] axes switching only with handwheel

[2] axis switching with handwheel and keyboard

Function	MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	AE-6 Input Value
Handwheel operation - Input of interpolation factor	7641	0	07	04	-	04	+ 0 = via keyboard + 1 = via PLC module 9036	0
- Handwheel traverse in "Programming"		1	07	09	-	06	+ 0 = disabled + 2 = enabled	
- Input of interpolation factor		2	07	10	-	06	+ 4 = via keyboard or PLC module + 0 = handwheel selection only in the operating modes HANDWHEEL and PROGRAMMING	
- Selecting the handwheel		3	10	13	-	07	+ 8 = handwheel selection and evaluation of the PLC inputs and outputs on the handwheel (keys, LEDs) possible in all operating modes	

Function	MP No.	Bit	TNC 2500	TNC 360	*NC 306	CNC 234	Input	AE-6 Input Value
Initializing parameters for HR							0 ... 2	0
Allocation of 3. handwheel via axis selector switch **(MP 7640 = 5)**	7645.0	0	-	04	-	04	+ 0 = position 1 -> Z-axis position 2 -> IV. axis position 3 -> no function + 1 = position 1 -> X-axis position 2 -> Y-axis position 3 -> Z-axis position 4 -> IV. axis position 5 -> no function	
		1	-	04	-	04	+ 2 = position 3 -> Z-axis position 4 -> IV. axis position 5 -> no function (only if bit 0 = 0)	
		2-7					reserved	
Evaluation of the LEDs and keys of HR 332 **(MP 7640 = 4)** or HR 410 in HR 332 mode **(MP 7640 = 4)**	7645.0		-	17	-	-	**HR 332** 0 = keys X, Y, Z, IV and their LEDs are evaluated directly by NC remaining keys: PLC I164 to I170 remaining LEDs: PLC O100 to O106 1 = keys: PLC I160 to I171 LEDs: PLC O100 to O107 **HR 410** 0 = keys X, Y, Z, IV and their LEDs are evaluated directly by NC remaining keys: PLC I164 to I171 remaining. LEDs: PLC O100 to O107 1 = keys: PLC I160 to I171 LEDs: PLC O96 to O107	
HR 410 in HR 410 mode **(MP 7640 = 6)**	7645.0		-	17	-	-	0 = keys X, Y, Z, IV, actual value transfer and their LEDs are directly evaluated by NC remaining keys: PLC I168 to I175 remaining LEDs: PLC O100 to O111 1 = keys: PLC I160 to I175 LEDs: PLC O96 to O111	

Function	MP No. Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	AE-6 Input Value
Allocation of 3. handwheel via MP **(MP 7640 = 5)**	7645.1	-	04	-	04	0 = simulation of 1. position of selector switch MP 7645.0 = 0 ⇨ Z-axis MP 7645.0 = 1 ⇨ X-axis + 1 = X-axis + 2 = Y-axis + 4 = Z-axis + 8 = IV. axis + 16 = no function	0
Axis selection procedure **(MP 7640 = 5)**	7645.2	-	04	-	04	0 = axis selected via selector switch according to MP 7645.0 1 = axis selected according to MP 7645.1	
reserved	7645.3 to 7645.7	- -	04 04	- -	04 04	no function	0 . 0
Counting direction of handwheel	7650	◆	◆	◆	◆	0 = positive counting direction 1 = negative counting direction	0
Hysteresis for electronic handwheel	7660	◆	◆	◆	◆	0 ... 65535 [increments]	10
Minimum interpolation factor handwheel	7670	03	I17	◆	◆	0 ... 10	0
Handwheel interpolation factor						0 ... 10	
slow (HR 130/3xx/410)	7670.0	-	17	-	-		0
medium (HR 410 only)	7670.1	-	17	-	-		0
fast (HR 410 only)	7670.2	-	17	-	-		0
%-factor of handwheel feed rate HR 410						0 ... 100 [%]	
slow (HR 130/3xx/410)	7671.0	-	17	-	-		50
medium (HR 410 only)	7671.1	-	17	-	-		75
fast (HR 410 only)	7671.2	-	17	-	-		100

Function	MP No.	Bit	TNC 2500	TNC 360	.NC 306	CNC 234	Input	AE-6 Input Value
Memory function for directional keys	7680		◆	◆	◆	◆	0 = not stored + 1 = stored	1
Memory test with power-on	7690							3
RAM test		0	◆	◆	◆	◆	+ 0 = test + 1 = no test	
EPROM test		1	◆	◆	◆	◆	+ 0 = test + 2 = no test	
EMERGENCY STOP test	7692		-	-	-	◆	0 = active 1 = inactive	0